Industry Power

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NOVEMBER 1956

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Power Services

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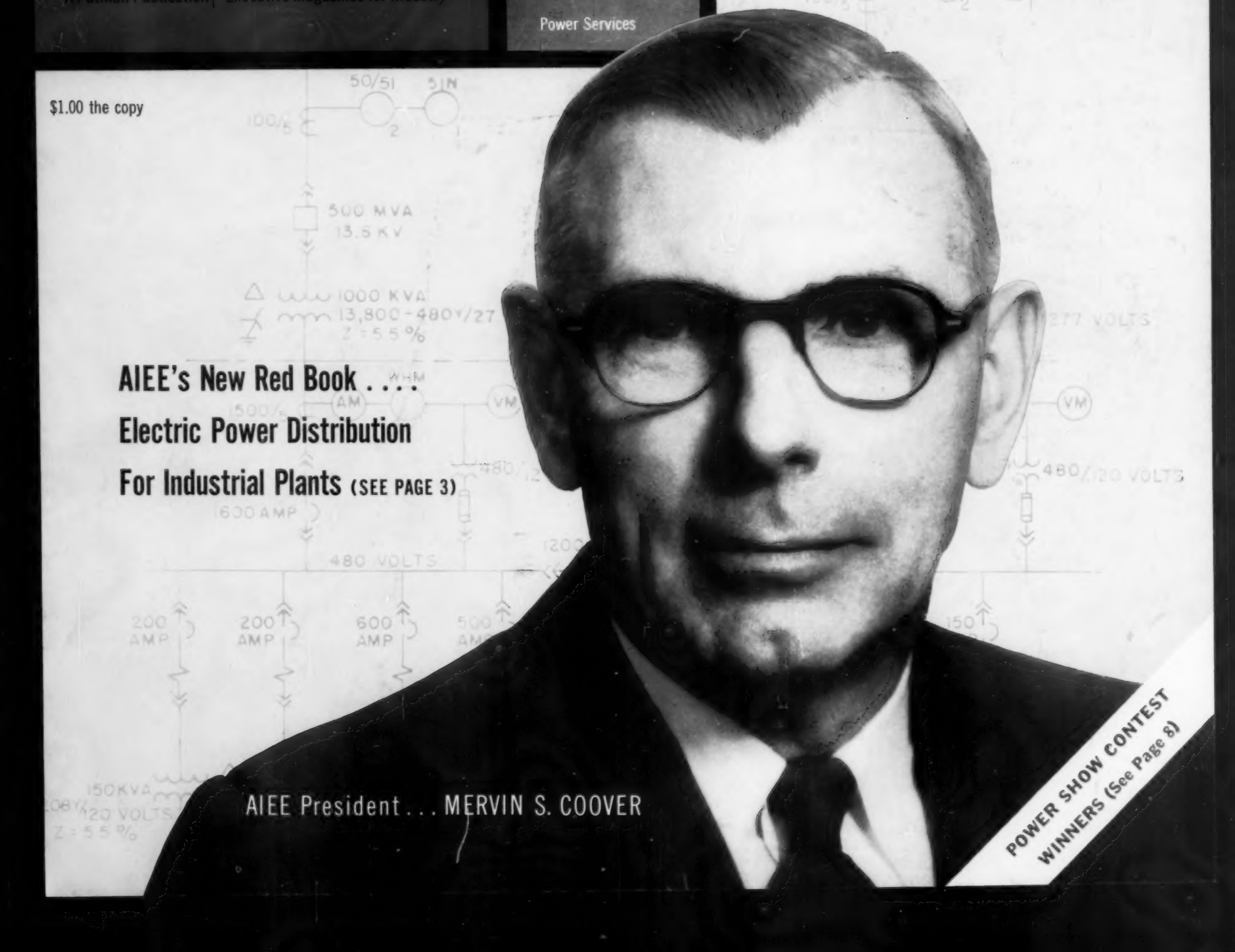

AIEE's New Red Book . . . . Electric Power Distribution For Industrial Plants (SEE PAGE 3)

AIEE President . . . MERVIN S. COOVER

POWER SHOW CONTEST WINNERS (See Page 8)

Detroit RotoStokers Type C-C —Important in Savings by this Modernization Award Winner

Motor Products Corporation, Detroit, won a "Power" Modernization Award with a program in which Detroit RotoStokers, Type C-C played an important part. Savings will pay for the investment in four years.

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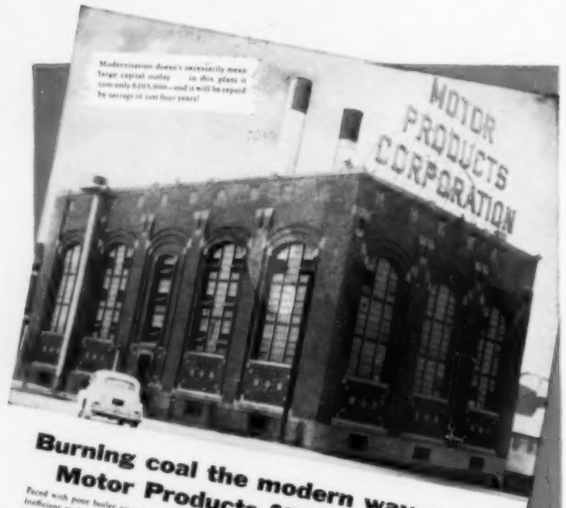

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Industry Power Forum

Your stake in societies

MERVIN S. COOVER, President
American Institute of Electrical Engineers
as told to Harold A. Bergen, Editor

YOUR STAKE IN WORK of professional societies .... such as that of the AIEE .... was never more evident than it is right now with publication of the new *Red Book, Electric Power Distribution for Industrial Plants*. In saying this, I address myself to you who are the engineers in industry who *do not design* products and who *do not sell* products. I address myself, rather, to you who *use* and specify the engineered products and services that make Basic Power Services available to industry. The *Red Book* is for you. And it is only a group of engineers such as AIEE assembled that could compile the accumulated wisdom of an industry into a volume of such great value to you.

Now, AIEE is not content just to publish such volumes as the *Red Book* for you. We offer much more if you will but see your stake in your professional societies.

Your personal stake in any professional society is determined by the aims you have set for your career. Professional challenge produces professional growth. If you will settle for being told what to do from day to day, you thereby choose the career of a *technical* engineer — a technician. But if you choose to hear the challenge of *professional* engineering, you will find that you have a great stake in your *professional* societies. When you choose to hear the call of professional challenge, you must abandon any attitude of refusing to give a little more until you get a little more. You must give full measure .... and then some. Part of that measure is contribution to those societies that sustain the professionalism with which you seek to become identified.

Some 85 men, for example, put many days (and nights) into the *Red Book*. You will find their names in the *Red Book*. But who can say that such mention is ample reward .... except in terms of professional achievement? The *Red Book* comprises effort of many men like yourself .... men in charge of electric distribution systems in industrial plants. They contributed part of their knowledge of loads, of controls,

About Mervin S. Coover

"Full measure .... and then some." These are words we borrow from Coover's remarks in the adjoining columns because we have personally observed him live by this philosophy which he recommends to others. And if there is any doubt about the success-breeding qualities of this philosophy of the "full measure .... and then some," we have only to look at Coover's career for reassurance.

He was awarded the bachelor of science degree in electrical engineering by Rensselaer Polytechnic Institute in 1914. His professional career was launched when he joined Montana Power Co. as an assistant in substation electrical construction. He then worked for Hutchinson Power and Light Co., Wilson Grinding Machine Co., and the University of Colorado .... with a hitch in the AEF thrown in. He joined Iowa State College in 1935 and became professor and head of electrical engineering administration and teaching. He maintained a consulting practice, as well .... serving teaching, civic, and engineering projects.

Coover's career as a member of AIEE bespeaks his philosophies about the stake of professional engineers in their professional societies. He has served AIEE in responsible positions on Section, District, and National levels. He is president of AIEE for the 1956-57 term .... serving, at the same time, as administrative assistant at Iowa State College (following his recent formal retirement from the teaching staff).

Coover's energy and vitality belie his years. His enthusiasm is contagious. And his modesty is to be admired. Above all, though, we are impressed with the endorsement his career gives to the philosophy he speaks in the adjoining columns.

New AIEE Red Book Ready . . . .

Electric Power Distribution for Industrial Plants

Long awaited as successor to the original edition (1945), the completely revised second edition (1956) of the AIEE *Red Book* is now available. It has been prepared by a special subcommittee of the AIEE Industrial Power Systems Committee. Basic information is included to determine load requirements, type of system, and voltages. Data are included to assist selecting transformers, circuit breakers, relays, meters, fuses, conductor, and miscellaneous equipment for present and future loads.

Companion to the *Red Book* is the new *Green Book, Grounding Of Industrial Power Systems*. The *Green Book* is a comprehensive extension of the *Red Book* chapter on grounding. It has been prepared by another special subcommittee of the AIEE Industrial Power Systems Committee.

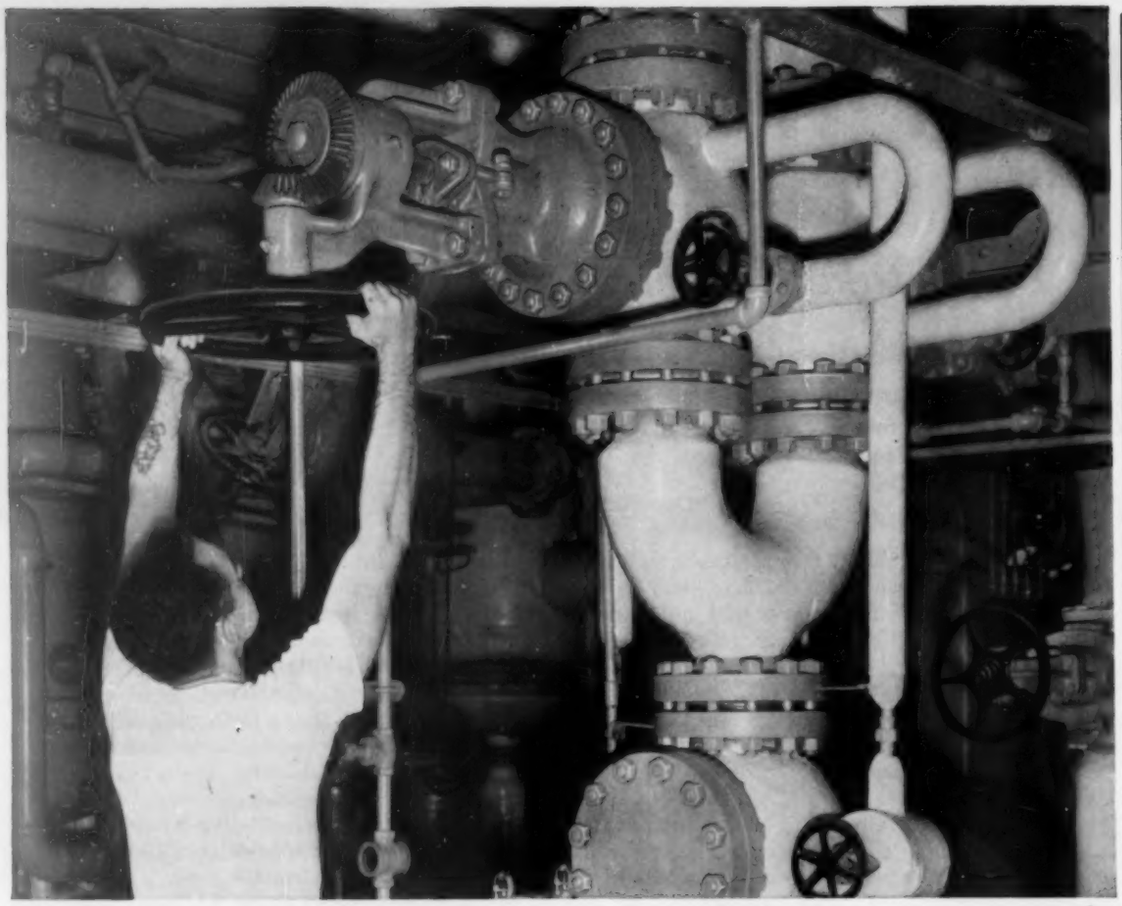
Red Book, 172 pages, is now available at $3.50 ($1.75 to AIEE members), each. *Green Book*, 41 pages, now is available at $1.40 (70c to AIEE members), each. Both *Red Book* and *Green Book* are paper bound. Order directly from: American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.

of circuits, of components . . . . and of countless other topics to which *you might* have made similar contribution. They are, and you could be, better professional men for all this. That is sufficient reward to cause many of these men to go on contributing . . . . to the coming *Grey Book* on commercial buildings practice, for example.

There is no doubt about this: Professional activity in societies demands that you give up an afternoon golf game or an evening movie. You have to make time. There is no economic penalty for professional growth, to say the least. But it does take an initial investment by you without, perhaps, immediately measurable return. Professional growth is money in the bank for you—where the initial stake is made by you.

Perhaps the biggest error you can make is in waiting too long to get started. Professional growth can begin well within the first year away from graduation. We do not want to have an old-man's organization, as far as AIEE is concerned. Indeed, a sampling of our Technical Sessions audiences shows a great many young men attending. There could be more of them.

What, then, comes out of Technical Sessions, committee work, and local Section activity of professional societies? Growth for the societies . . . . as manifest through such publications as the AIEE *Red Book*. Growth for members . . . . as manifest in the professional growth they achieve. Such growth is recognized by management. Management seeks engineers with a demonstrated professional consciousness. Such rewards can be yours if you will but see your stake in the professional societies. ♦♦



Here is 14-year proof of Crane low-cost valve performance on feed water

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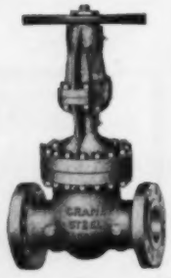
For full information on the big, complete Crane line, contact your local Crane Representative or write to address below.



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Well, the answers have to do with editorial and circulation research, with reader and plant qualification, and with all such factors that help us make sure that INDUSTRY POWER serves the men who matter most in managing the Power Services.

For complete details about why we verify,

See page 52

A PUTMAN PUBLICATION

Industry Power

For men who manage power services

VOLUME 71 NO. 6 NOVEMBER 1956

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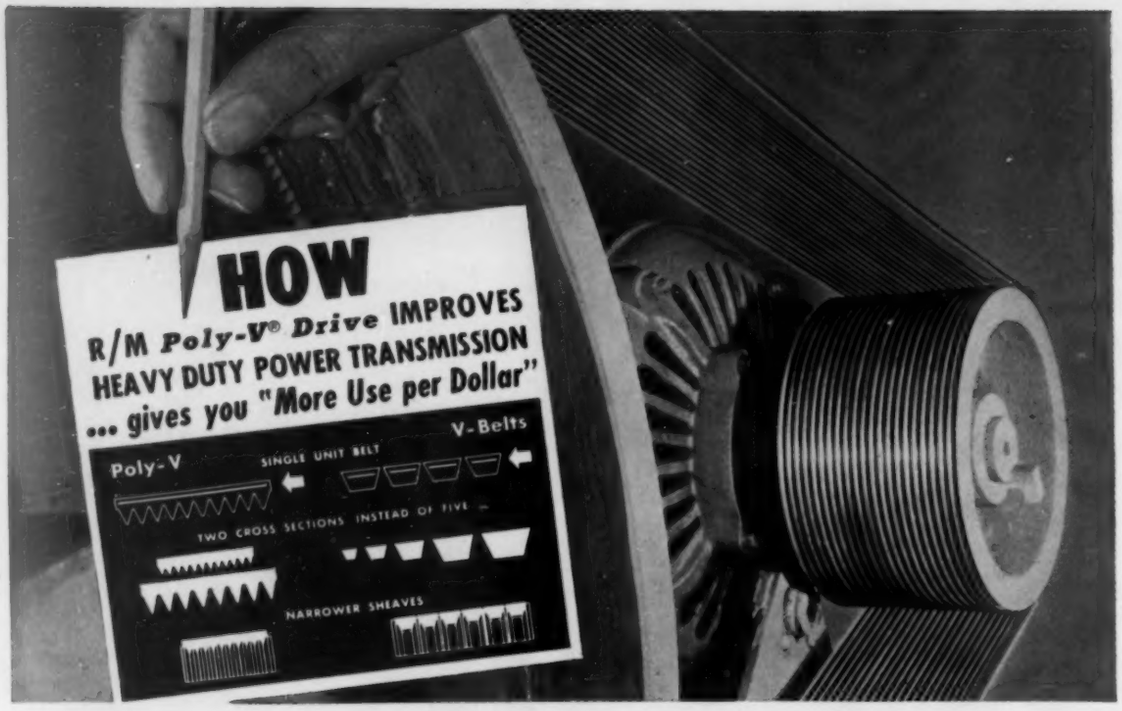

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R/M engineers who developed Poly-V Drive will be glad to give you further data on these and other advantages of this amazing new drive . . . and to work with you to determine the installation that will mean "More Use per Dollar" for your application. Contact an R/M representative . . . or write for a copy of Poly-V Drive Bulletin #6638.

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nuclear news

. . . about industry power

NUCLEAR HEAT TO GET GAS FROM COAL

Tests have begun to determine feasibility of using nuclear heat to produce gas from coal. Under consideration is a reactor that would operate around 1370 C. First experimental model of possible future nuclear units for coal gasification is under test at Morgantown, W. Va.

FUEL ELEMENT PRODUCTION EXCEEDS EXPECTATIONS

Babcock & Wilcox is producing 60 fuel elements monthly as compared to the originally estimated rate of 35 monthly for the Materials Testing Reactor being built by the Phillips Petroleum Company for the AEC. While B&W spokesmen say that present capacity of the company's Lynchburg fuel element fabrication plant is "considerably in excess" of the production rate it is now maintaining, the building is undergoing a 150-percent expansion to accommodate other existing and future contracts.

NUCLEAR POWER HERE TOO SOON?

Has nuclear power arrived too soon? Dr. Willard F. Libby, AEC Commissioner, suggests "Atomic power has perhaps come 15 years too early for the United States. I say this because we have at present sufficient coal and petroleum reserves, and we are not in real need of a new source of energy for our industrial empire. This is not the case with other countries, however. Great Britain needs power urgently today and is pushing hard to attain it. In a few weeks Britain's first dual purpose reactor — a producer of both plutonium and electric power — will be dedicated, and other power

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the LOCATOR

Turn to page 53 and you'll find a complete listing of all advertisers and the local offices they have ready to serve you. Information in a hurry is yours with INDUSTRY POWER's LOCATOR. . . .
see page 53

plants are scheduled to be in operation within the near future. Russia, too, is developing power reactors but, like the United States, is not in urgent need of atomic power today. Her incentive in developing large electrical generation plants is the desire for the technological supremacy of the world, with doubtlessly underlying political motivation. It becomes clear, then, that atomic power is on the verge of becoming a reality, and that we in the United States must develop it as quickly as is prudent."

WE NEED MORE REACTORS

More reactors to test materials for atomic energy application are urgently needed, if the United States is to maintain its nuclear leadership, according to Stanley B. Roboff, Atomic Energy Division, Sylvania Electric Products. Roboff contends that the future of nuclear reactor technology is riding primarily on solution of materials problems in nuclear fuels, control elements, and other components. Properties of nuclear materials may change to such an extent after a period of irradiation that the materials are no longer suitable for their intended use. Roboff warns that we are in immediate prospect of having far too little test space for civilian atomic needs. ♦♦

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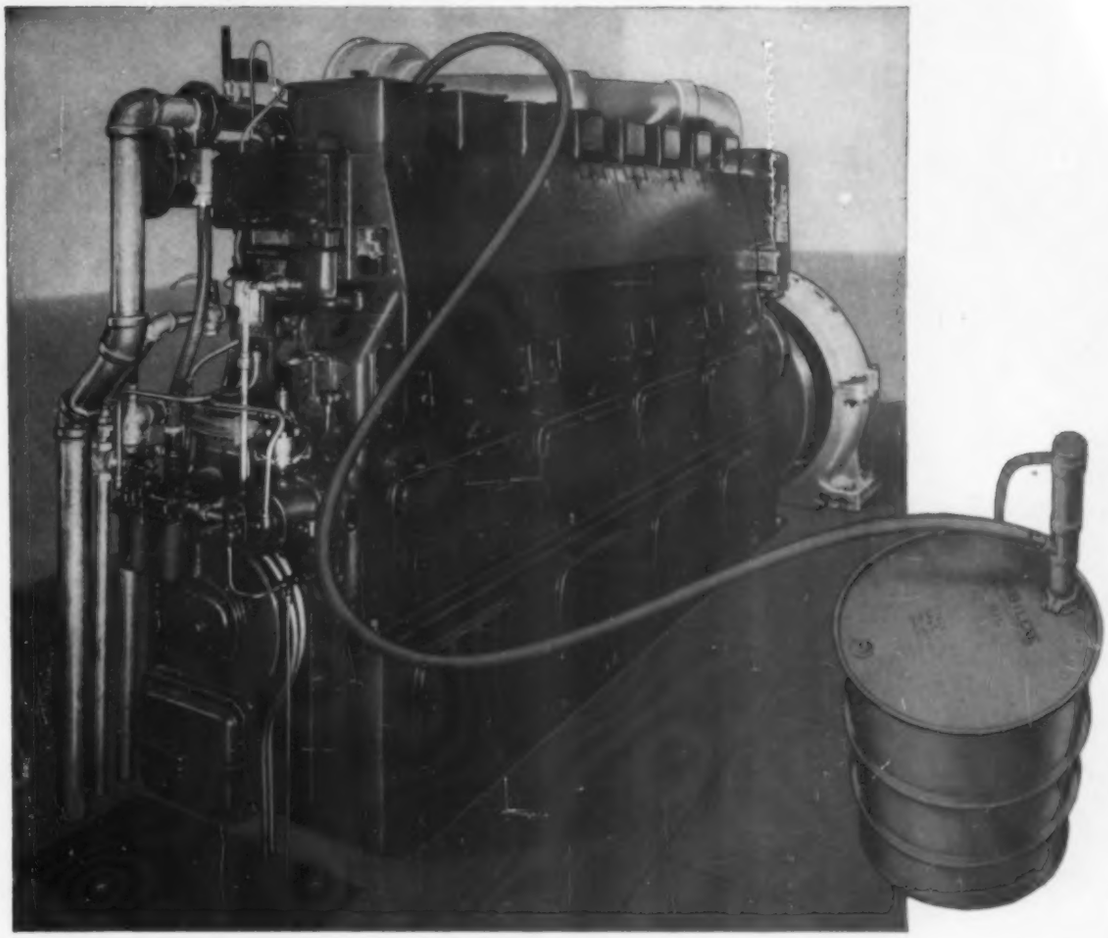

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Proudly we announce the names of the winners in The Power Show Contest, conducted by INDUSTRY POWER . . .

MEET THE WINNERS

First Prize Award: Edmund C. Smith

Edmund C. Smith, superintendent of power, Toledo plant, Interlake Iron Corp., is a Power Services man who has worked his way up through the ranks. He was born in Webster, N. Y. Having become interested in electrical engineering in high school, Smith took a correspondence course with the American School of Correspondence.

In 1916, 40 years ago, Smith joined Interlake as an electrician in the coke department. All equipment was dc-operated. In 1925, when a completely new powerhouse and boilerhouse were built, a start was made in changing over to ac power. This was Smith's big chance. He was the only electrician in the plant who was familiar with this newfangled ac. He was promoted to assistant power superintendent on the spot.

He has a firm belief that strict inspection and maintenance are the keys to successful operation. He tours his plant at least once a day to see how things are going and to stay on a first-name basis with the 60 men who work for him.

Smith still finds time, however, for three hobbies — bowling, fishing, and gardening. He is a member of the Toledo Chamber of Commerce. He is a past president of the East Toledo Club, a group of men from industry and business with a common interest in civic affairs. He has been president of East Toledo Junior Football League.

Edmund C. Smith, Interlake Iron Corp.

Second Prize Award: David H. Noble

David H. Noble, electrical engineer, Central of Georgia Railway Co., is a typical southern gentleman. He is a native of Kentucky and received his bachelor of science degree in electrical engineering from the University of Kentucky in 1949. Like most young engineers, he is a veteran of World War II. He served as electrician's mate with the U. S. Navy aboard an LCI in the Philippines.

Railroading has been his chosen field since graduation. He joined the Atlantic Coast Line while his "sheepskin" was still warm. He went through a training program from special apprentice (engineering trainee) to draftsman in the electrical engineer's office. In 1952, he was promoted to traveling electrical foreman. His responsibilities included electrical supervision of air conditioning, lighting, and power.

Noble came to the Central of Georgia in 1955 as staff electrical engineer. He supervises all electrical facilities, exclusive of signals and communications. Setting up maintenance standards, planning expansion and modernization, scheduling work, and inspecting work in progress . . . . all this is part of a day's work for Noble.

He is a Registered Professional Engineer (Georgia), an Associate Member of AIEE, and a member of the AIEE Land Transportation Committee. (General Application Division)

David H. Noble, Central of Georgia Railway

late news

. . . about industry power

• 2000-percent rise in power coming

More than 11,000-billion kwh of electricity will have to be produced in 2006 to meet the nation's requirements, according to an estimate by William Webster, executive vice president of New England Electric System. He said: "My concern is that we may have been victims of the prevailing inhibitions and consequently failed to have sufficient faith that the next generation will maintain the rate of progress that this generation has established." Stressing his conservatism, Webster pointed out that straight projection of the nine-percent rate of growth over the last 20 years would result in a figure four times this large for the year 2006.

• Study electrostatic coal cleaning

Bituminous Coal Research, Inc. has started a new fundamental research study, with the help of the Quaker Oats Company, to determine feasibility of using the electrostatic separation principle in cleaning fine coal. Quaker Oats' designed machine creates a high-voltage field, in which impurities pick up an electrostatic charge. This charge separates impurities from pure objects passing through cleaner. Objective of the research is to determine operating data for comparison with conventional fine coal cleaning method costs.

• Sound the alarm

Twenty-first annual survey of university and college placements, by Northwestern National Life of Minneapolis, says the fantastic 1956 demand for engineering graduates has hampered spring classroom sessions, lured away sorely needed technical instructors, and resulted in sharp practices by some recruiters. Report finds average base starting pay at around $420 and as high as $450, compared to $390-$410 a year ago.

• Engineering shortage acute—or not so

Engineering profession has never received as much Congressional notice as in the past two years. Proposals call for Federally-financed scholarships, subsidies to engineering teachers and institutions, loans to students, tax credits, Federal financing of textbooks, matching grants for state science plans, Federal engineering and scientific academies, and many others. None of these bills were acted upon by the committees, but the shortage question did receive considerable attention from a number of Congressional committees. Latest bill proposes an extension of the present vocational training program through matching grants to states by authorizing technician training programs on the same basis.

On the other hand, RCA has surveyed its engineers at Lancaster, Pa., who felt that 13 percent of their time could be delegated to technicians and 6 percent to clerical aids. Company deduced that such delegation would mean that 99 engineers could perform functions now requiring 122 engineers. Survey breakdown shows that major areas in which engineers would delegate their work are expediting, general errands, ordering supplies, handling purchase requisitions, engineering testing, development shop follow-up, making graphs, drafting, and routine testing. ♦ ♦

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. . . checks testing procedures, test solutions and chemical feed equipment.

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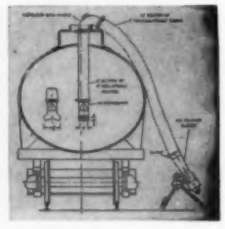
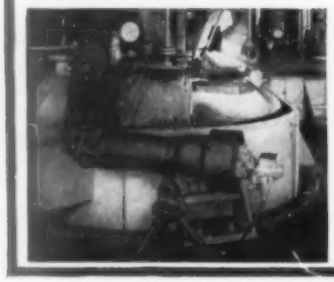
Vano Design "A" Ventilator plus a few accessories feeds large air volume into tank car, driving out fumes, stagnant or hot air for workers' safety and comfort.





Vano Design "A" supplying fresh air in Reactor Room of Synthetic Rubber Plant.

Vano Design "A" Ventilator supplying fresh air to men working in wing compartments, fuselages, etc.

Powered by a ½hp motor, and equipped with the exclusive Coppus axial-flow propeller-type fan, this general-purpose blower delivers 1500 CFM of fresh air. It supplies ventilation for tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments and fuselages, and other confined places. Weighs only 103 lbs. Uses 8"-diameter flexible canvas tubing ("Ventube").

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Vano Design "C" equipped with 8" discharge tubing removing welding fumes.

Vano Design "C" equipped with two suction lines removing welding fumes for operators' safety.

For withdrawing welding fumes from confined places or directly from the welding rod ...or for expelling fumes or hot air from enclosed vessels. You can get it with 8" suction inlet for 8" non-collapsible tubing ...or with multiple inlet nozzles for 5", 4" or 3" suction hose. The discharge outlet takes 8" "Ventube". Powered by a ½hp motor, it weighs only 85 lbs.

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- Advertisers' nearest sales and service offices are indexed alphabetically. See pages 53 and 54.
- Advertisements are indexed by products in handy guide. See page 48.
- Important literature is indexed by products. See page 42.

this month's comment . . . .

what does the Power Show Contest reveal?

INDUSTRY POWER's 1956 Power Show Contest is over. Winners (see page 8) have been notified and are preparing for their week at the Power Show later this month. Looking back, now, what does the Power Show Contest reveal?

Considering all your entries in composite, we see many important attitudes and ideas in the minds of you who manage the Basic Power Services in industry. We see in you:

- Sharp-eyed cost consciousness, recognizing that improvement of the Power Services in your plant can mean more profit dollars for your company.
- Eagerness for products and ideas that are new.
- Intention to keep your plants modern and an awareness that you need firsthand data to sell this intention to top management.
- Desire to provide well-informed engineering supervision . . . . a desire for "post-graduate" technical information.
- Appreciation for any shortcut that will more quickly establish personal contacts with the people who can help you do your job better.

Such are your combined thoughts as we read between the lines of your Power Show Contest entries. These are the motivations that bring you to attend the most complete, convenient, and concentrated exhibit of equipment for the Power Services in the country.

The Power Show Contest entries show clear thinking about why your company would benefit by you attending the Power Show. We hope that all you who attend keep these reasons well in mind—that you plan your trip for maximum, specific benefit to yourself and the company you represent.

Harold A. Bergen
Editor

P. S. We look forward to meeting you at the INDUSTRY POWER Power Show booth (No. 423-425), and at the ASME Annual Meeting at the Hotel Statler, New York come November 26.

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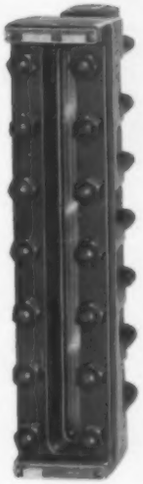

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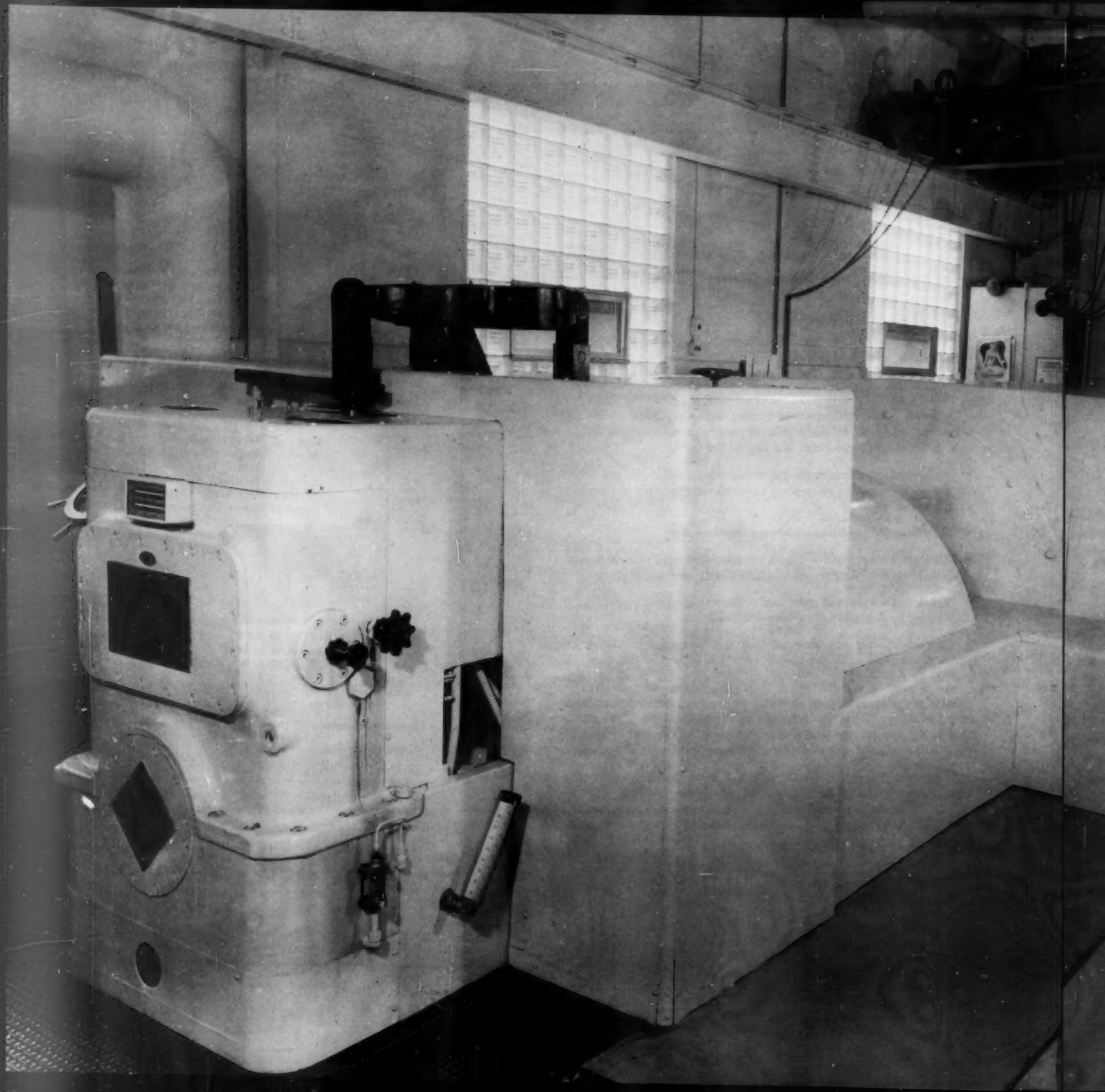


How planning for economic justification today and modern plant tomorrow give Marathon Corporation

Pay-as-you-go Steam-power modernization

HAROLD A. BERGEN
Editor

SAVINGS OF $200,000 per year over present operating costs are expected by Marathon Corp. when its Rothschild (Wis.) steam-power modernization program is completed next summer. This saving is the result of programmed expansion and improvement in which new, major powerhouse equipment is installed as soon as it economically justifies itself .... at the same time paving the way for even greater savings when anticipated equipment is added at a later date.

how Marathon's program works

Marathon's modernization program at Rothschild, long in the planning stage, got its start when it became obvious that their 1000-kw Corliss steam engine (installed in 1910) needed extensive overhaul. Cylinder liners had to be replaced. Its generator needed rewinding. Routine maintenance was high. The Corliss engine takes up more room than its generating capability justifies by modern standards. It was also found that by abandoning regular operation of the engine, substantial savings in insurance premiums could be made. The basic program worked out this way:

STEP 1: Install 600-psig backpressure turbogenerator for initial operation at 300 psig and 100 F superheat. Revamp an existing 150-psig boiler for 300-psig operation with new turbogenerator. Provide some external water conditioning equipment and eliminate sources of oil contamination in condensate.

Revamped boiler is an 871-hp Springfield unit, originally designed for 300 psig and 100 F superheat but first operated at 150 psig. It now provides the 300-psig steam. Changing over from 150- to 300-psig operation required new combustion control, boiler feed pumps, valves, and refractory work.

Allis-Chalmers 4000-kw WA-series noncondensing turbogenerator is key to Rothschild plant program

Operating the Springfield boiler at 300 psig justifies some external water conditioning equipment. A sodium zeolite-pressure filter combination is the first step in building a modern hot-lime, hot-zeolite system. (A blend of 50 percent zeolite-softened water and 50 percent raw water along with internal treatment is proving satisfactory.)

Oil-contaminated condensate has been eliminated by replacing all of the old reciprocating steam engines on mill ventilating fans with electric drives. Oil contamination is now down to a safe level.

A 4000-kw, 600-psig 750 F Allis-Chalmers backpressure turbogenerator, designed for initial operation at 300 psig, completes Step 1.

STEP 2: Replace two existing boilers (Babcock & Wilcox Sterling types, each rated 400 hp at 150 psig, saturated) with a 90,000 lb/hr, 600-psig Union Iron Works boiler to supply turbogenerator. Add a 150,000 lb/hr hot lime softener to present water treating system for hardness and silica reduction. Install new 350,000 lb/hr deaerating heater.

Step 1 was completed in 1954. Step 2 will be completed in the fall of 1957. Following steps have no completion dates but will depend on economic justification.

STEP 3: Remove or retire to standby duty in 1958 a battery of six bark-burning Scotch-Marine boilers in favor of bark-burning equipment on the new 600-psig boiler. (Each of the old Scotch-Marines is rated 150 hp at 150 psig.)

STEP 4: Replace two more Babcock & Wilcox Sterling boilers, each rated 400 hp at 150 psig, saturated with a second 90,000 lb/hr, 600-psig steam generator.

STEP 5: Add condensing-extraction turbogenerator delivering 120-psig extraction steam for pulp cooking and drying.

Basically, then, Marathon is abandoning low-pressure steam and power generating equipment for new high-pressure boilers and turbogenerators. They are temporarily keeping the Corliss along with a 150-psig condensing 1000-kw, 480-volt turbogenerator as a standby unit.

(continues on page 30)

Smart purchasing, maintenance ingenuity, and stable loads combine again to win award for Wolverine's Johnson plant (Hersey, Michigan). Here's

How Johnson plant stays on top

JOHN N. KEEN, Manager
G. W. LOCKWOOD, Chief Operator
Wolverine Electric Cooperative

reported by R. W. De Moss
Assistant Editor

MAINTENANCE INGENUITY plus efficient, hard-working staff and hard-bargaining purchasing have again made Wolverine Electric Cooperative's Johnson plant, Hersey, Michigan, the most efficiently run plant of its kind in the country. Secret of Wolverine's operation resolves into two basic factors. First, there is economy in maintenance and repair. Second, there is economy in management and purchasing.

Three times, now Johnson plant has earned the distinction of being the nation's most efficiently operated REA internal combustion generating station. This three-time victory has been achieved by the same six-engine team of dual-fuel engines and essentially the same efficient operating staff.

Johnson plant had its beginning in 1946 when O. & A. Electric Cooperative built a small plant at Hersey. Two 1010-hp Model JS-8-T supercharged Cooper-Bessemer diesel engines were installed. In 1949 a 1650-hp Model LS-8-GDT Cooper-Bessemer unit was added. When Wolverine Electric Cooperative was formed, Johnson plant was assigned to carry base-load for the integrated system. To meet this load, three 10-cylinder, 2-cycle, Model 31AD18 Fairbanks-Morse dual-fuel engines were installed. Each of these units is rated 3500 hp at 277 rpm. First unit went into service in October 1951, second in December 1951, and third in February 1952.

planned purchasing pays off

Wolverine manager John N. Keen incorporates many economies by shrewd purchasing and by keeping an ear tuned to fuel price fluctuations. Lubricating oil costs amounted to 4.8 percent of total production expense at Johnson plant during 1955. To achieve this low expense, Keen has two outdoor 4000-gallon lubricating oil storage tanks plus a 2000-gallon storage tank in the plant basement. This storage enables Wolverine to save 5¢/gal on lubricating oil through large-volume purchases.

Plant used, in previous years, a blend of 70-percent gas oil and 30-percent diesel fuel. This mixture was blended at the refinery at an average cost of 10¢/gal in 1953. Prime fuel oil today is No. 4 gas oil, with an average cost of 9.37¢/gal in 1955. Wolverine is also experimenting with blends of No. 6 fuel oil.

Keen inaugurated a policy of keeping daily fuel consumption records on each engine (Fig. 1). These records are valuable in forecasting potential engine failures before they occur by comparing daily engine efficiencies.

In addition to capable management in Big Rapids, Michigan, Wolverine has operating staff at Johnson that is noted for its repair and maintenance procedures and techniques.

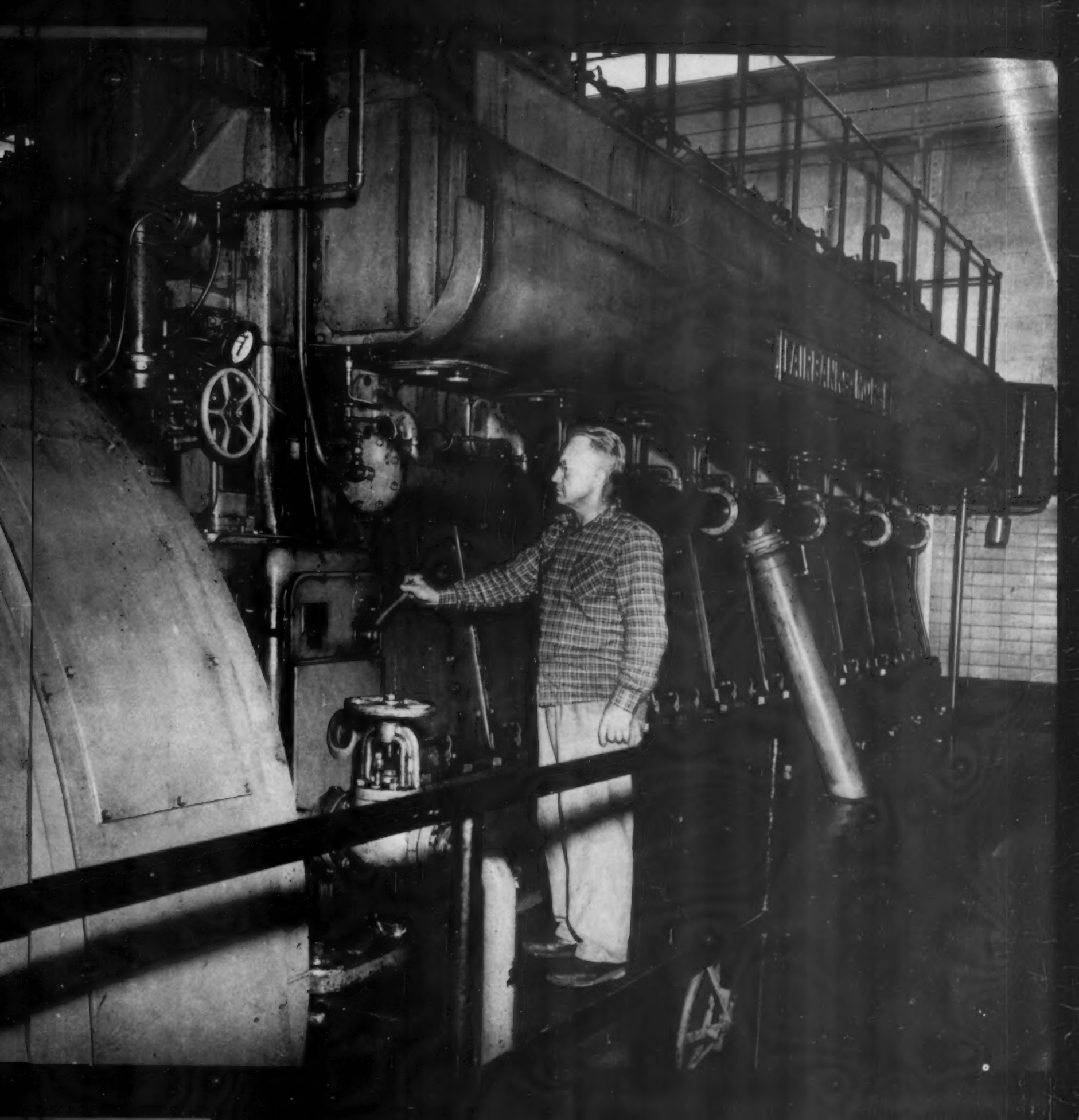
dependability comes first

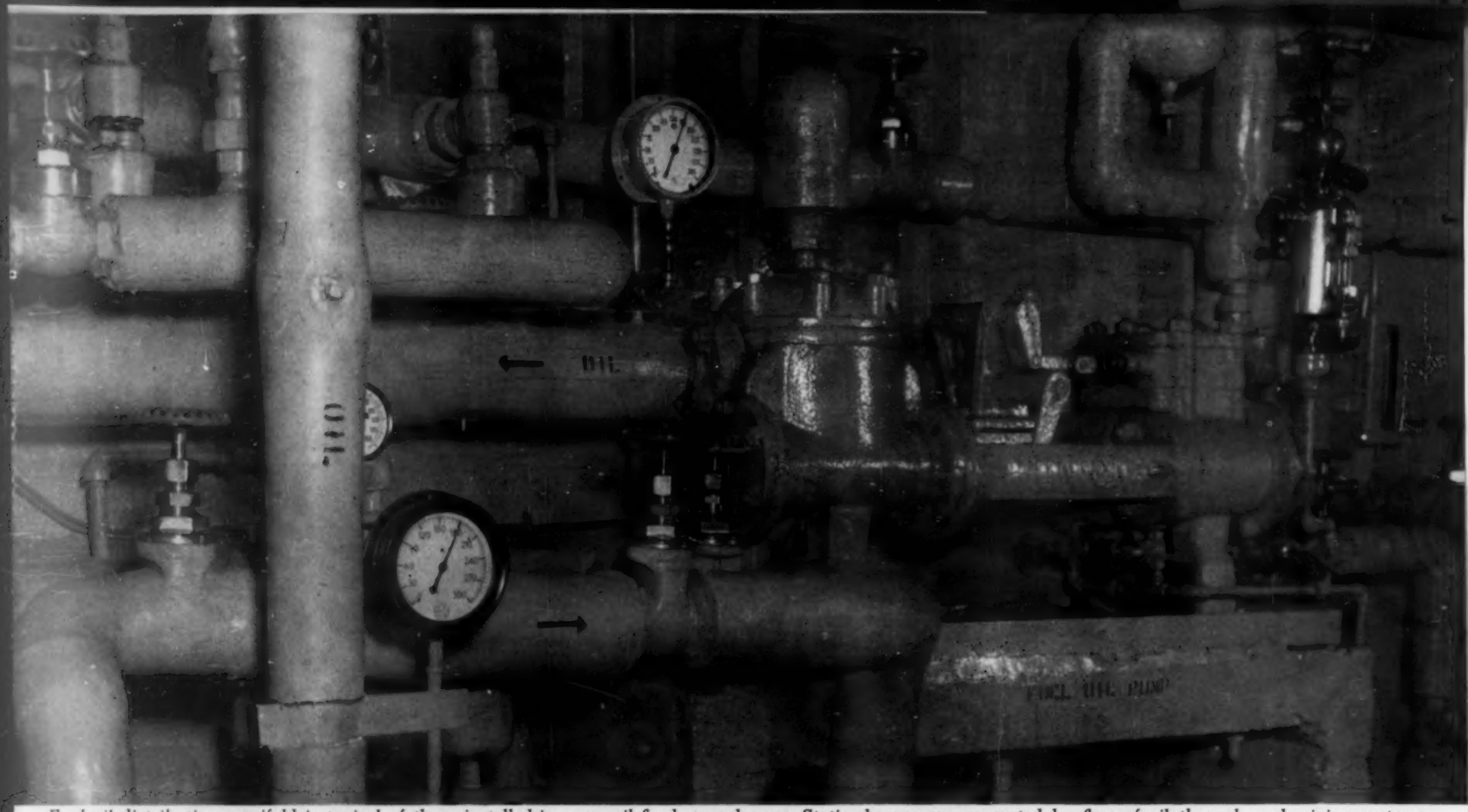
Not a "spit and polish" operation by Chief Operator G. W. (Jim) Lockwood's own admission, operations at Johnson are aimed at providing *dependable* power. *Economical* operation is second in importance. Lockwood believes in making best use of all engine downtime. He firmly believes, "if you can't buy a better one, it pays to fix up the old one." He does not believe in scrapping anything that can be salvaged. Cracked cylinder heads, scored cylinders, and burned valves are all repaired in the plant's own shops. When cylinder heads are cracked because of excessive detonation or from other causes, Lockwood removes metal around the damaged area and plug welds the head. Finish grinding puts the head back in storage ready for use when needed.

Another big item is fuel injector maintenance. When engine efficiency drops, as determined from daily fuel consumption, the ailing engine is completely inspected at the first opportunity. Fuel injectors are replaced during these inspections. Depending on time available, valves may be replaced, too. All fuel injector maintenance is per-

(continues on page 25)

G. W. Lockwood, chief operator, keeps a critical eye on engine operation to achieve maximum efficiency.





Fuel oil distribution manifold is typical of those installed in many oil-fired powerhouses. Static charges are generated by flow of oil through such piping systems.

You may be playing with fire
without knowing that you have . . . .

Static Hazards with fuel oils

ROBIN BEACH, Consulting Engineer
with R. W. De Moss, Assistant Editor

If you use fuel oils, you can head off possible disaster by reading what one of the industry's foremost authorities recommends for handling liquid fuels safely. Drawing on years of personal experience and firsthand observation, Mr. Beach speaks with great respect of the hazards of handling fuels.

WHETHER YOU KNOW about it or not, static electricity is always working against you.

Electrostatic hazards are quite common in power plants using fuel oil products, and these hazards develop by several devious means — all subject to spark ignition. Important ignition causes are:

- Fuel oil flow through pipes into or out of storage tanks.
- Spraying of atomized fuel oil into furnaces.
- Extraneous electrostatic causes, such as escaping jets of steam from blow holes developing in steam pipes near oil discharges.

These causes of fire and explosion accompanying fuel oil use in Industry's Power Services are never-ceasing threats to safety.

Fuel oil storage tanks range in capacity from large cylindrical tanks, as commonly seen on tank farms, to relatively small, horizontal, cylindrical tanks. Regardless of size, oil storage tanks all possess similar basic provisions for safety. Tanks have pressure-vacuum vents to relieve pressure from compression of air within tank spaces and from vapor emitted while being filled, or to relieve vacuum when tanks are emptied. For safety, oil is introduced into the bottom of the tanks during filling to avoid splashing at the liquid level surface, as from overhead splash filling — a potential hazard that can generate dangerous electrostatic sparks sought to be eliminated. Tanks are thoroughly grounded by cables attached to a system of driven ground rods, pipes, or other underground structures.

Static electricity is generated as fuel oil makes

sliding contact while traveling through its containing pipe line. Steel pipe is used because of its economy and strength. Unfortunately, steel pipe causes more electrostatic charge generation than pipes of lower dielectric constant, such as brass pipe. Dielectric constant of steel pipe ranges between 3 and 4, while brass pipe is about 2.1. Dielectric constants of fuel oils are low, generally less than 2.5. No. 1 oil (kerosene) has a dielectric constant of 2.1, almost identical with that of brass pipe.

dielectric constants are important

If the dielectric constant of the pipe and the oil happen to be the same, then static electricity generation caused by the flowing oil would be practically nil. Flowing through steel pipe, the fuel oil is electrified to negative polarity because of steel's higher dielectric constant. Positive electricity on the pipe is discharged as rapidly as it is generated by grounding the pipe with carefully installed grounding cable. Of course, the outdoor storage tanks always must be thoroughly grounded, not just for discharging its generated static electricity, but for discharging any lightning strokes that may strike them during electric storms.

Negative charges, mostly electrons, that enter a storage tank from a fill pipe, whose discharge is near midbottom of the tank, presumably would flow to the surface and repell themselves to the tank wall — thus discharging to earth as do their positive counterparts on the pipe lines. But electrons, even under the force of their accumulating potential, cannot readily flow to the tank wall by electric conduction because the oil has a fairly high electric resistivity. Electrons, hence, must move toward the tank wall by translation from mutual self-repulsion and by attraction to the steel wall by their grounded positive counterparts. This they do very slowly because of the retarding forces of the high-viscosity oil. Then, as myriads of electrons closely approach the wall, largely in their final accumulation by forces of attraction, they strangely do not freely enter the grounded steel tank wall for discharge to earth. This behavior comes about because of partial discontinuities of the electric resistance at the tank wall. This is caused, in part, by high interfacial resistance between the oil and the insulating iron oxide that coats the steel — and, in part, by the second high interfacial resistance between the iron oxide and the steel of the wall (Fig. 1).

sparks can jump four feet

Experience shows that sparks commonly jump this potential barrier from the oil surface to the steel storage tank wall slightly above the oil level. Where highly viscous oil (such as cylinder oil) has been pumped into large storage tanks, sparks of four-foot lengths have been observed. Voltage required to initiate sparks of such length and under these

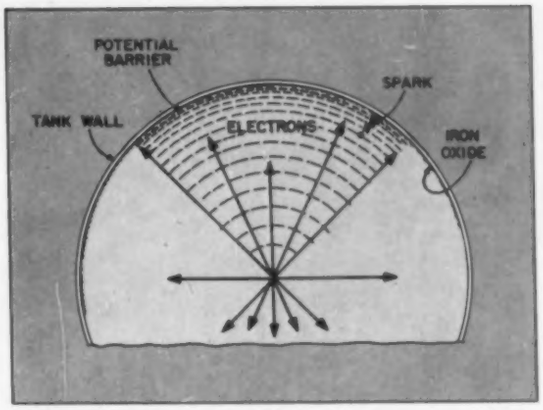


Fig. 1—Iron oxide insulating barrier causes high resistivity to electron flow, resulting in sparking.

circumstances is in the order of 1,000,000 volts. Where the oil flash-point temperature is high and no flammable vapors have occurred from splashing, no flash fires or explosions result from these sparks.

On the other hand, if fuel oil has been heated for ease in pumping, sufficient vapor may have evolved above the liquid to create a flammable mixture, permitting flash fire from this electrostatic sparking. Devastating explosions have occurred from similar causes, which have blown tanks apart, extensively tearing the steel plate — culminating in fires from the spreading oil.

Several decades ago, fuel and lubricating oils were first stored in large steel storage tanks. Oil was splashed down into the tanks from the overhead fill pipes near the tank roofs. This "splash-filling" system proved extremely dangerous, created vapor from the splashing, and formed foam and deep layers of bubbles. All this was extremely hazardous due to electrostatic sparks. Today, splash filling is rarely found. In its place, the underfeed system is almost universally employed as a precaution against electrostatic fire and explosion hazards.

Serious explosions have occurred where fuel oil enters a power plant boiler and is atomized by compressed air while flowing into the furnace. Explosions have occurred despite safety devices installed to automatically shut off oil flow if normal ignition does not occur promptly. In starting a boiler, the ignition system begins to spark as soon as atomized oil enters the combustion chamber as a flammable mixture. If the atomized oil does not ignite after a reasonably short and safe interval, oil flow must be stopped in the interests of safety. If, however, protective devices fail to function, oil may flood the bottom of the fire box — setting up a flammable mixture throughout the furnace back to the smoke stack breeching. Under these conditions, ignition of the flammable vapor mixture would cause

(continues on page 22)

Safer because it's Simpler

■ Of all boiler water level controls, we believe Magnetrol to be the safest. Certainly it is the simplest.

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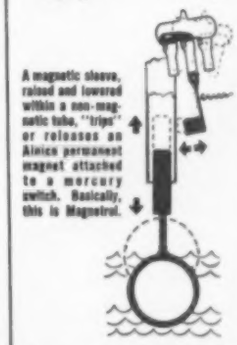
A magnetic sleeve, raised and lowered within a non-magnetic tube, "trips" or releases an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

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What to do when you need more water than you can get? By recirculating plant water at Aircraft Engine Division plant in Chicago,

Millwater system saves water and money for Ford

GLEN O. BOSTON, JR.
Supervisor of Mechanical Engineering
Ford Aircraft Engine Division
with Donald Hartley, Managing Editor

WATER MAY BE A MAJOR problem in your plant's development and expansion, even if nature provides an abundant supply in your area. Engineers at Ford Aircraft Engine Division in Chicago, have developed an effective solution. Our set-up can be used for future water requirements on existing water distribution systems in any plant.

what the water problem was

Plant area of 486 acres (consisting of jet engine test cells, component testing, machining, heat treating, plating, assembly, and office area) had to be supplied by a water pumping distribution system with a capacity of only 4500 gpm. Actual water requirements for this plant are calculated at approximately 7850 gpm. This means that with maximum use of existing pumping and distribution systems, the plant would still be short 3350 gpm of water.

An analysis of our requirements showed that 4250 gpm of water was needed for heat-treat and welding operations. This water could be re-used if properly collected, cooled, filtered, and redistributed. Nine such millwater recovery systems were installed: six with 500 gpm capacity each; two with 400 gpm capacity each; and one with 450 gpm capacity.

how system works

Fig. 1 schematically illustrates a typical millwater system. Water flows by gravity from each piece of process equipment into concrete trenches. Trenches have removable steel plate coverings and convey the water to a concrete pit or reservoir. Reservoir is divided by a concrete weir pier. Weir pier provides a settling section in the reservoir for miscellaneous debris that has accidentally entered the concrete trench system. Reservoir is the base for a Niagara Model 44 - 240 Aero Heat Exchanger with capacity to cool 500 gpm of water. Exchanger removes 3,200,000 Btu/hr at 75 F entering air wet-bulb temperature and 100 F entering water temperature. This type of heat exchanger is built in two sections and is essentially two heat exchangers in one casing. Each section has a fan, cooling coils with cleanable headers, spray nozzles, eliminator plates, and automatic temperature control system. Intake and discharge air ducts are connected to the heat exchanger and to a louvered penthouse located on the building roof. A vertical deep well turbine-type Deming Fig. 4700 pump, with 500-gpm capacity at 210-foot head, is mounted on top of the reservoir clean side with its vertical shaft and impellers extending into the reservoir. A Brassert automatic self-cleaning strainer that handles 500 gpm at 2-psi pressure drop is also mounted on top of the reservoir. Water flows from pump discharge to automatic strainer, and then through heat exchanger to the distribution system that serves the processing equipment.

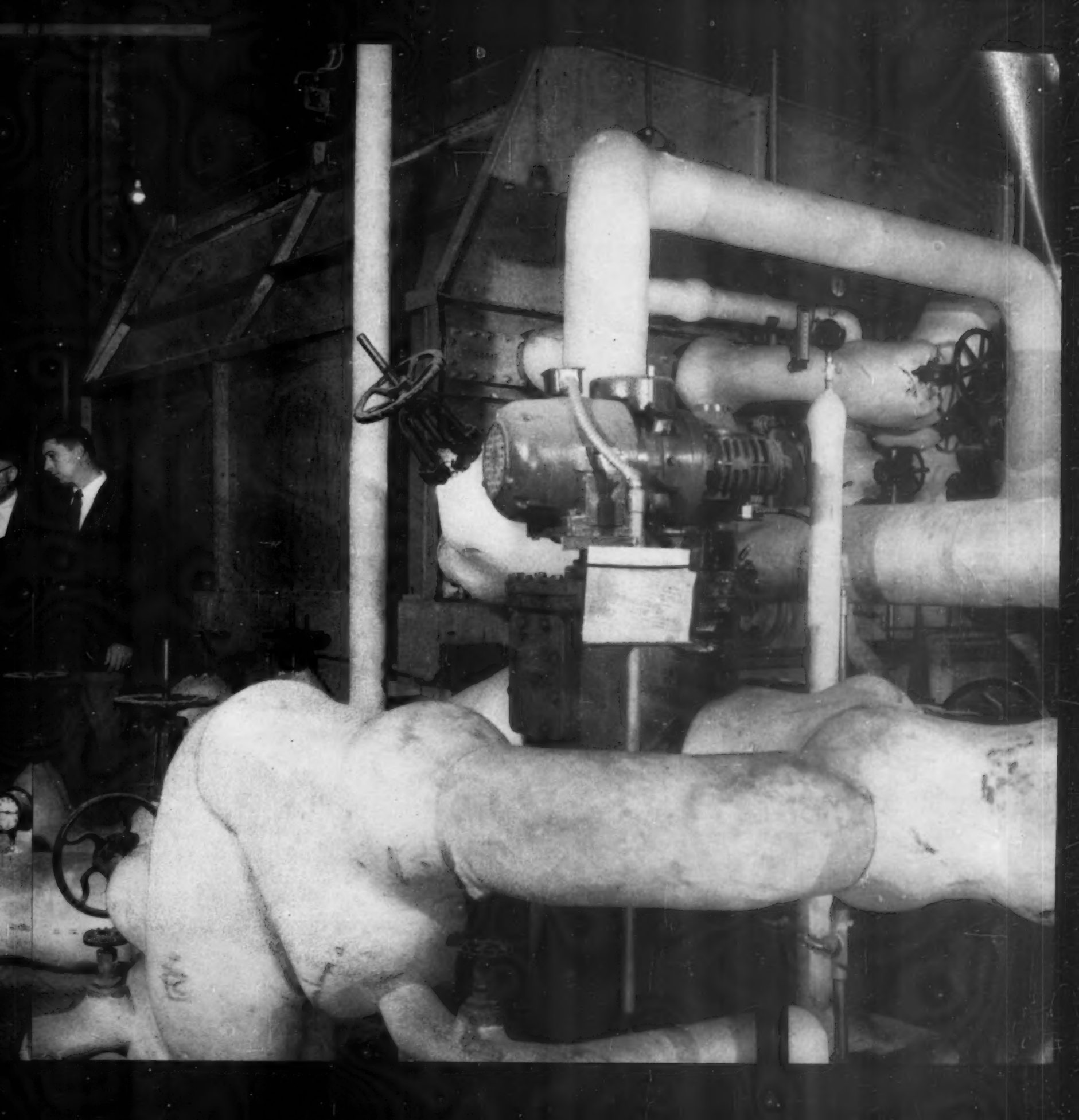
temperature control is automatic

Temperature control equipment on units is by Minneapolis-Honeywell Regulator Company. Sequence of automatic operation provides a temperature controller with a remote sensing bulb, (located in the heat exchanger discharge water piping) to modulate a damper motor. This operates a damper, controlling air flow across the cooling coil in one heat exchanger section. Second heat exchanger section has a modulating motor (operating in parallel with the modulating motor in the first section) that controls a damper to regulate air flow across the cooling coil.

Freeze-up protection is provided by a temperature controller mounted in the intake duct-work. This operates a plant air damper that provides a mixture

(continues on page 23)

Author Boston points to one of two Deming pumps that circulate water from reservoir through system.



Air conditioning and refrigeration

IV -- Properties of atmospheric air

Here are some of the principles behind your day-to-day air conditioning and refrigeration problems. Each article in IP's POWER BASICS covers some facet of air conditioning or refrigeration that will help you do your job better. Each one can be read without reference to the others and without any loss of continuity. Single sets of the complete series will be available without charge. Send in your request now. We will hold it until complete set is ready. Quantity prices upon request.

JOHN F. LEE
Professor of Mechanical Engineering
North Carolina State College
with Donald Hartley, Managing Editor

PROPERTIES OF the mixture that constitutes the atmosphere may be presented conveniently in a graphic form known as the *psychrometric chart*. A psychrometric chart is prepared for one particular barometric pressure. Although correction curves are sometimes available for other barometric pressures, it is often more convenient and more accurate to calculate the properties. In some cases the temperature range is not wide enough to permit solving certain problems, and properties of the air and water vapor mixture must be calculated.

Vapor pressure expressions may be developed by writing an energy equation for the adiabatic saturation process. This equation may then be expressed in terms of dry-bulb and wet-bulb temperatures and specific humidity. It is more convenient, however, to use a semiempirical equation first developed by Carrier:

$$P_v = P_w = \frac{(P - P_w)\ (T_d - T_w)}{2800 - 1.3\ T_w} \qquad (1)$$

where P_w = vapor pressure corresponding to wet-bulb temperature (obtainable from steam tables)
P_v = actual vapor pressure
T_d = dry-bulb temperature
T_w = wet-bulb temperature
p = total or barometric pressure. Pressures may be measured in psi or inches of Hg, and temperatures in degrees F or R. Dry-bulb and wet-bulb temperatures are measured with a psychrometer.

Relative humidity is given by Eq. (4) in Part III of this series, $RH = p_v/p_g$
where p_g = saturation pressure of vapor corresponding to the dry-bulb temperature and is obtainable from steam tables.

Specific humidity is given by Eq. (7) in Part III of this series,

$$w = 0.622\ \frac{P_v}{P - P_v}$$

Specific volume and **density of air in mixture** are obtained by applying Dalton's law and the equation of state of an ideal gas as follows:

$$v_a = \frac{R_a T_a}{P_a} = \frac{R_a T_a}{p - p_v} \qquad (2)$$

and

$$d_a = \frac{P - P_v}{R_a T_d} \qquad (3)$$

Specific volume and **density of vapor** are found from Eq. (3) in Part III of this series as

$$v_v = \frac{v_a}{w} \qquad (4)$$

and

$$d_v = w d_a \qquad (5)$$

Specific volume and **density of mixture** are

$$d_m = d_a + d_v = d_a + w d_a = d_a (1 + w) \qquad (6)$$

and

$$v_m = \frac{v_a}{1 + w} \qquad (7)$$

Enthalpy of the mixture equals the sum of enthalpy of one pound of dry air and enthalpy of the accompanying vapor, each taken at the dry-bulb temperature of the mixture, or

$$h = h_a + w h_v \qquad (8)$$

where $h_a = 0.24\ T_d$ and h_v is obtained from steam tables. Note that if we would take one pound of mixture for this definition, we would have two variables — dry air and vapor. By considering one pound of dry air (a constant quantity) and the vapor that accompanies it, we are dealing with a variable quantity of mixture but only one thing varies — the amount of vapor. Enthalpy of vapor may be taken from the saturation-temperature table of the steam tables, since it is very nearly independent of pressure at the low vapor pressures encountered in the atmosphere. When high temperatures are encountered, as in some drying processes, effect of vapor pressure must be taken into account. This may be done by assuming the constant-pressure specific heat capacity of superheated vapor to be 0.44 Btu/lb F.

EXAMPLE: Atmospheric air at 14.7 psia has a dry-bulb temperature of 90 F, and a wet-bulb temperature of 80 F. Compute (a) vapor pressure, (b) relative humidity, (c) specific humidity, (d) density of dry air in mixture, (e) density of vapor in mixture, and (f) enthalpy of mixture.

SOLUTION: (a) From steam tables, saturation pressure at a wet-bulb temperature of 80 F is 0.5069 psia. Then, from Eq. (1) we get for the vapor pressure

$$P_v = 0.5069 - \frac{(14.7 - 0.5069)\ (90 - 80)}{2800 - (1.3 \times 80)}\ \text{psi}$$
$$= 0.454\ \text{psi}$$

(b) Saturation pressure at a dry-bulb temperature of 90 F (mixture temperature) is 0.698 psia. Then, from definition of relative humidity, we get

$$RH = \frac{P_v}{P_g} = \frac{0.454}{0.698} = 0.65$$

(c) Assuming that vapor and air in the mixture are ideal gases, specific humidity is obtained from Eq. (7) of Part III of this series as

$$w = 0.622\ \frac{0.454}{(14.7 - 0.454)}$$
$$= 0.02\ \text{lb vapor/lb dry air}$$

(d) Density of dry air is, from Eq. (3),

$$P_a = \frac{(14.7 - 0.454) \times 144}{53.35 \times 550}$$
$$= 0.07\ \text{lb/cu ft}$$

(e) Density of vapor is

$$P_v = \frac{w}{P_a}(0.02 \times 0.07)$$
$$= 0.0014 \text{ lb/cu ft}$$

(f) Ehthalpy of vapor, h_v, at the dry-bulb temperature of 90 F, is found from steam tables to be 1100.9 Btu/lb. Specific heat of air at the dry-bulb temperature is 0.24 Btu/lb per degree F. Then enthalpy of the mixture from Eq. (8) is

$$h = 0.24 \times 90 + 0.02 \times 1100.9$$
$$= 43.6 \text{ Btu/lb dry air}$$

psychrometric charts

Several different psychrometric charts are available. Generally speaking, a psychrometric chart is a graphic plot with specific humidity and vapor pressure as ordinates and dry-bulb temperature as abscissa. Specific volume of mixture, wet-bulb temperature, relative humidity, and enthalpy of mixture appear as parameters. Any two of these properties, including wet-bulb temperature, fix the condition of the mixture. Note that a psychrometric chart is plotted for one barometric pressure, usually 14.7 psia, and is based on one pound of dry air and the quantity of vapor that accompanies it. Again, a constant reference mass is provided, since dry air composition is constant, whereas mixture composition is variable. If barometric pressure does not differ too greatly from that of the chart, the data may be used with little sacrifice of accuracy. Otherwise, properties that are seriously affected by pressure must be calculated by the methods given in the preceeding section.

Fig. 1 shows a typical psychrometric chart in skeleton form to aid in identifying the various coordinates and parameters on the actual chart.

All air-conditioning processes are steady-flow in character and are most conveniently expressed in terms of a unit mass of dry air flow. Work effects are usually negligible. Energy equations, neglecting potential energy and kinetic energy changes and work.

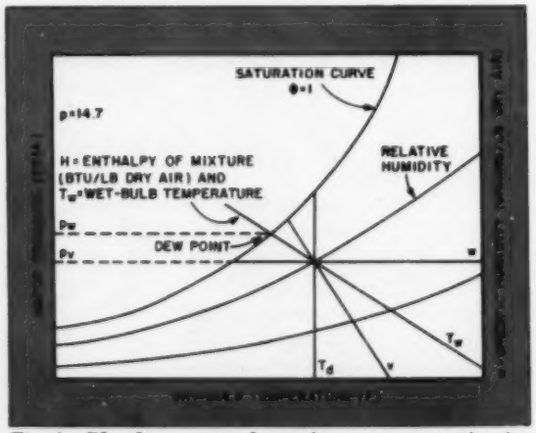


Fig. 1—Phychrometric chart. Any two properties, including wet-bulb temperature, fix mixture condition.

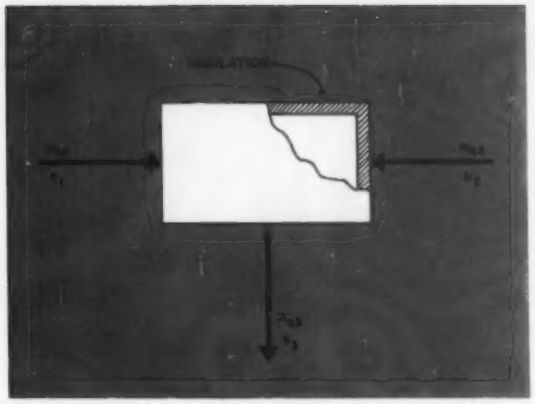


Fig. 2—Adiabatic mixing process. Flow is steady and no water vapor enters chamber from outside system.

may be written for a unit mass of dry air flow as

$$h_{a1} + w_1 h_{v1} + m_f h_{f1} = h_{a2} + w_2 h_{v2} + m_{f2} h_{f2} + q \quad (9)$$

$$h_1 + w_{f1} h_{f1} = h_2 + w_{f2} h_{f2} + q \quad (10)$$

where subscripts 1 and 2 refer to entrance and exit conditions. Symbol m_f is mass of liquid water per unit mass of dry air that crosses the system boundary, and h_f is saturation enthalpy of the liquid water corresponding to its temperature. Usually the difference in liquid water mass entering and leaving the system is the amount evaporated, so that

$$w_2 - w_1 = m_{f1} - m_{f2} \quad (11)$$

mixing process

Consider two air streams that mix adiabatically in a chamber and then emerge as a single stream, as shown in Fig. 2. Flow is steady, the mixture reaches equilibrium, and no water enters or leaves the chamber except that which accompanies the air. Under these conditions the energy equation is written

$$m_{a1}(h_{a1} + wh_{v1}) + m_{a2}(h_{a2} + wh_{v2}) = m_{a3}(h_{a3} + w_3 h_{v3})$$

But $m_{a1} + m_{a2} = m_{a3}$ and

$m_{a1} w_1 + m_{a2} w_2 = m_{a3} w_3$

for steady flow. Eliminating m_{a3}, this last equation is written

$$\frac{m_{a1}}{m_{a2}} = \frac{w_3 - w_2}{w_1 - w_3}$$

Similarly, it can be shown that

$$\frac{m_{a1}}{m_{a2}} = \frac{(h_{a3} + w_3 h_{v3}) - (h_{a2} + w_2 h_{v2})}{(h_{a1} + w_1 h_{v1}) - (h_{a3} + w_3 h_{v3})}$$

and therefore

$$\frac{m_{a1}}{m_{a2}} = \frac{h_3 - h_2}{h_1 - h_3} = \frac{w_3 - w_2}{w_1 - w_3} \quad (12)$$

Three possible conditions can exist if Eq. (12) is solved: $RH_3 < 1$, $RH_3 = 1$, or $RH_3 > 1$. This last condition means that some vapor has condensed. Actual state is $RH_3 = 1$, or is that of saturated air when wet-bulb temperature equals dry-bulb temperature of mixed stream.

Adiabatic mixing process may be shown graphically on the psychrometric chart, as shown in Fig. 3. A straight line joins points representing the states of the two original streams, since w and h are linear on chart. Final state is found by dividing the line 1-2 into segments proportional to the relative masses of dry air before mixing takes place. Fig. 4 shows the solutions when $RH_3 = 1$ and $RH_3 > 1$.

EXAMPLE: If 500 cfm of air at dry-bulb and wet-bulb temperatures of 90 F and 76 F respectively, mix with 1000 cfm of air at dry-bulb and wet-bulb temperatures of 80 F and 65 F respectively, find (a) enthalpy, (b) dry-bulb temperature, (c) wet-bulb temperature, and (d) relative humidity of resulting mixture. Total pressure of all mixtures is 14.696 psia.

SOLUTION: (a) To find the masses of dry air before mixing, we know that the dry air and vapor in each mixture occupies the volume of each mixture. Dry air, however, is at its partial pressure, equal to the total pressure of the mixture less the vapor pressure. From the psychrometric chart, vapor pressure of the mixture at point 2 (see Fig. 3) is 0.37 psia. Partial pressure of the dry air in this mixture is

$$P_{a2} = P_{m1} - P_{v2} = 14.696 - 0.37$$
$$= 14.33 \text{ psi}$$

Similarly, partial pressure of the dry air in the mixture at point 1 is

$$P_{a1} = P_{m1} - P_{v1} = 14.696 - 0.222$$
$$= 14.47 \text{ psi}$$

mass of dry air at point 2 is

$$m_{a2} = \frac{P_{a2} V_2}{RT_2} = \frac{14.33 \times 144 \times 500}{53.35 \times 550}$$
$$= 35.2 \text{ lb/min}$$

(continues on page 32)

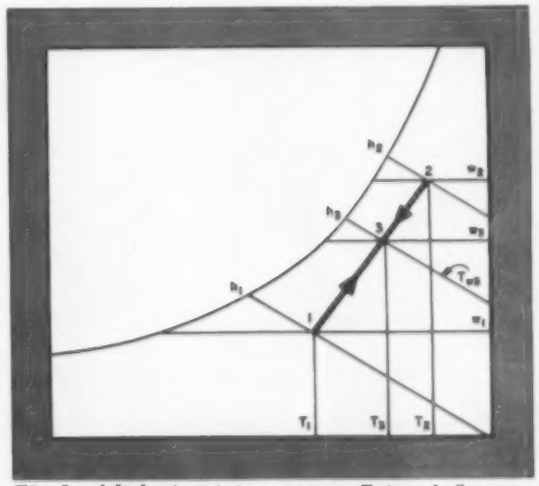


Fig. 3—Adiabatic mixing process. Points 1, 2 represent states of original streams, 3 is final state.

For Most Economical Operation

transmit electric power at higher voltage and install

SORGEL

Substations at load centers

•

Saves Copper. The Substation can be placed near the load center, so that shorter secondary feeders and smaller primary lines can be used. Improved voltage regulation.

Speeds Expansion and Earlier Production. SORGEL substations are shipped complete in one or more factory-assembled units, on a substantial steel base, completely wired and tested, ready for installation and final connection. This saves the extra expense of buying separately the transformers, switches, fuses, insulators, circuit breakers, and other accessories; also saving the extra labor cost and trouble assembling and connecting on the job.

Quiet Operation. The sound level of SORGEL dry-type transformers is well below the established standards. They are particularly adaptable for any indoor installation; in hospitals, libraries, schools, institutions, office buildings, and other structures where low sound levels are an important factor.

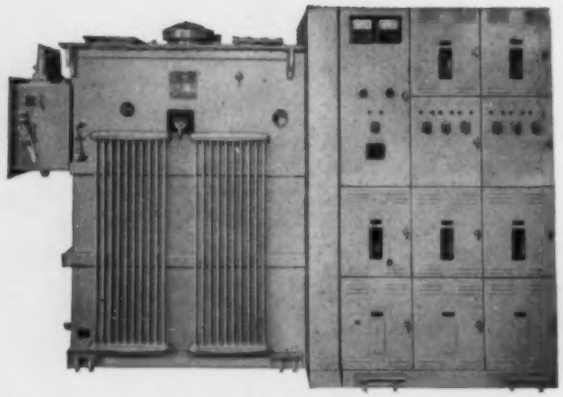
Types. Either dry-type or Askarel-cooled transformers are available with any type or make of switchgear, or from any substation manufacturer.

Sizes up to 3000 Kva. All voltages up to 15 KV.

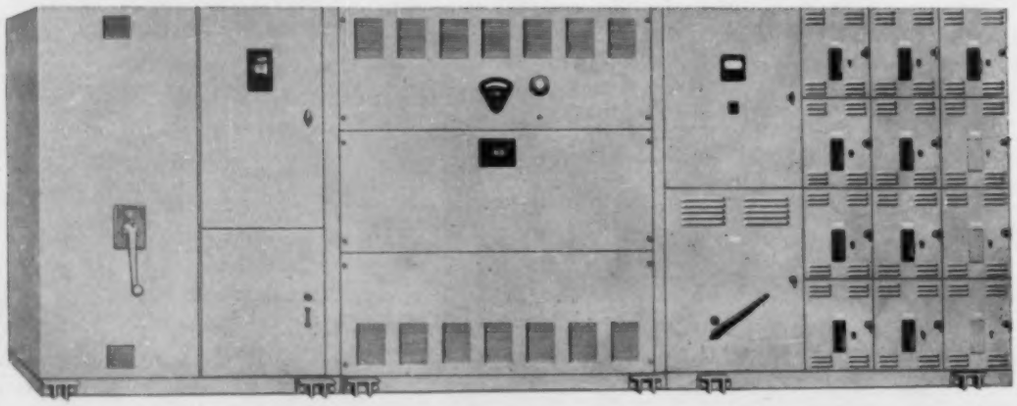
"Packaged" Units for Indoor Installations

Engineered to meet your exact requirements

Not necessary to design or change your installation to fit a "standard"



500 Kva, 13,800 volt Askarel-cooled SORGEL transformer, with primary liquid filled switch, secondary meters, and circuit breakers.



2000 Kva 3-phase, 13,200 volts dry-type transformer, with primary switchgear, metering, and secondary breakers.

For nearest SORGEL representative see the "LOCATOR" pages in this issue.

SORGEL ELECTRIC CO., 841 West National Ave., Milwaukee 4, Wis.

40 years' experience in the development, manufacturing and application of transformers

Circle 111 on READ-N-CIRCLE card for more data

Fuel oil hazards

. . . starts on page 16

a highly destructive and costly explosion to occur.

Such a situation took place in a large power plant in New York State, resulting in a costly explosion that demolished the steel work of the huge new furnace. Cause of the explosive ignition seemed shrouded in mystery after it was discovered that the obvious cause — the electric ignition system — had not operated at all. The protective safety relay failed and permitted oil to atomize with compressed air until the entire furnace was filled with an explosive mixture. Oil was inches deep in the furnace bottom. No other feasible and plausible reason could account for the ignition except from electrostatic sparks generated at the spray nozzle orifices. Under these circumstances, electrostatic sparks doubtless were the cause of ignition and the culminating violent explosion.

Where safety controls are indicated, they are generally inexpensive to install and simple to maintain.

use these safety measures

Here are several salient safety controls for handling fuel oils:

- Permanently ground all piping carrying fuel oil to and from storage tanks. If piping is long, ground it at 100-foot intervals to buried grounding cables.
- Ground all types of storage tanks — not alone to dissipate static electricity, but to harmlessly discharge any induced or direct lightning currents.
- Although fuel hoses are manufactured with static wires within their rubber or plastic composition throughout their length from nozzle to coupling, ground the hose nozzle before connecting it to the tank it is filling. This practice will equalize any possible sparking potential difference and, thus, eliminate possible explosion of the *empty* hose line.
- Use clamp-on hose connectors for filling operations — required in New York city and a few other safety conscious cities. (This is a superior safety practice that should be legislated into nation-wide service.)
- Fill all tanks, regardless of size, by under-surface-filling connections.
- When heating viscous fuel oils is necessary for pumping, use thermostatic controls to prevent overheating that would form explosively hazardous vapor mixtures.
- Above all else, pump petroleum products into tanks slowly. Generated static electricity increases about linearly with pumping rate. Under violations of this basic premise, accumulating electric charge of increased magnitude within the oil mass can cause sparking to the tank walls with explosive possibilities. ♦ ♦

Millwater systems save

. . . starts on page 18

of plant air and outside air above 32 F during the winter months. An auxiliary switch on the modulating damper motor shuts off the fan motors when dampers controlling air flow across the cooling coils are fully closed. Water for the heat exchanger spray nozzles is recirculated by a pump on the heat exchanger. A solenoid valve installed in the spray water piping opens and closes upon fan start and stop respectively.

auxiliary equipment

For trouble-free operation pit ejectors and automatic liquid level equipment are installed on the reservoirs for cleaning operations and to supply the very small amount of water makeup that the systems require.

Water in our millwater systems is chemically treated with a commercial compound (a complex phosphate as sequestering agent along with other chemicals) to prevent growth of algae and rust. This treatment is regularly checked for concentration. Necessary blow-down is automatically provided by the self-cleaning strainers.

Millwater systems may not only solve your plant's water problem, but will also save operating dollars. Take a look at the economics of one of our typical millwater systems. Equipment and installation costs amount to $38,000.00. This does not include piping to process equipment because that cost would exist using either city water or millwater. City water cost to our plant is $0.12 per 1000 gallons. Typical millwater system uses 500 gpm, or 30,000 gph, or 720,000 gpd. This amounts to a saving of $86.40 per day, or $31,536.00 per year. Cost of water treatment, operation, and maintenance for one unit amounts to $2,500.00 per year.

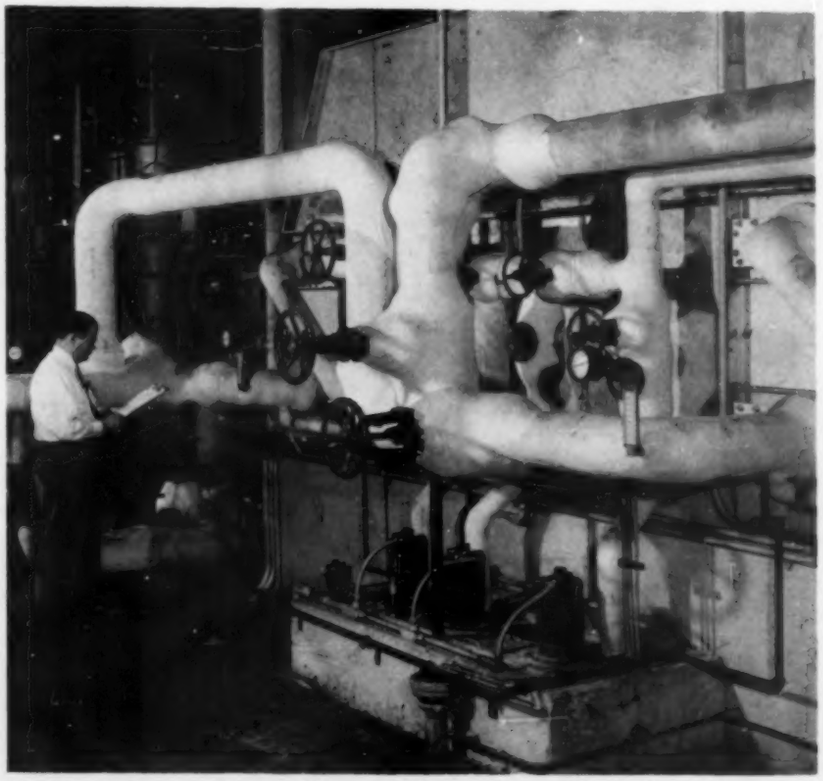
save $30,000 a year

So net savings from using millwater instead of city water is $29,036.00 per year. In this way our typical millwater system can be amortized in one year and four months. Also, on the asset side for millwater system, must be added the tremendous cost of larger pumping and distribution systems that would otherwise be necessary.

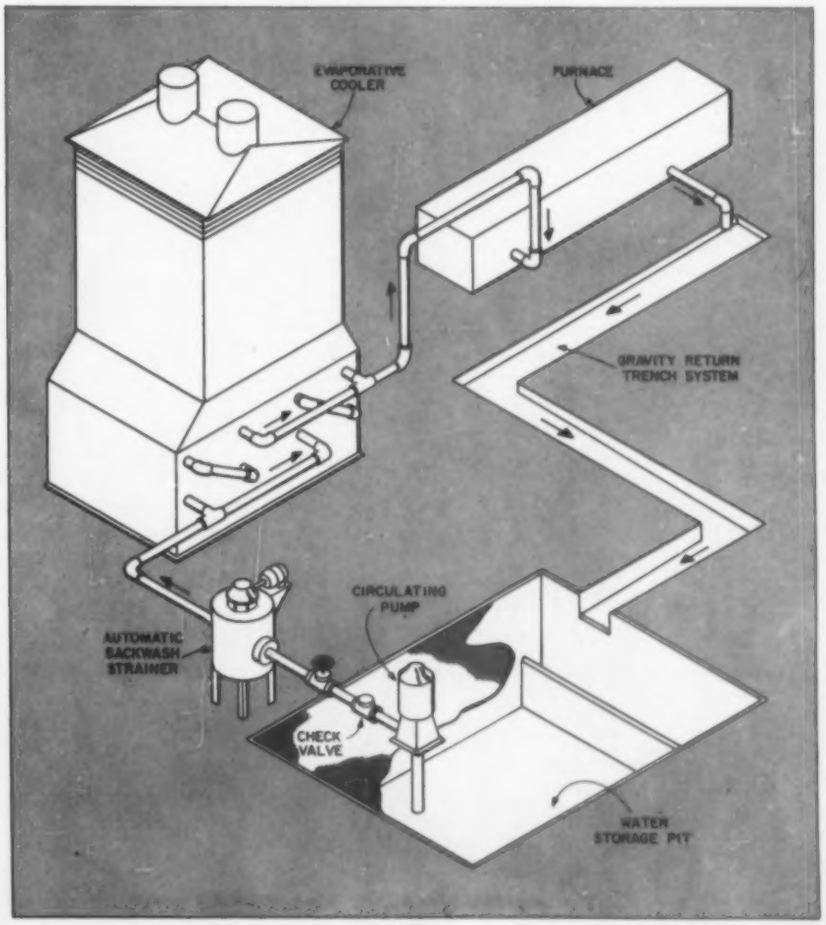
look at your plant

So analyze your plant's water requirements. If you find requirements are crowding your system's capacity, look for areas where water may be readily re-used on a twenty-four hour basis. Typical areas will be heat-treating furnaces, ovens, production welding equipment, production equipment, and so on. If water shortages exist, millwater systems will not only solve your engineering problems but will also save you money. At least, that has been our experience since we installed millwater systems in our Chicago plant and overcame our water shortage. ♦♦

Aero heat exchangers are manufactured by Niagara Blower Company, Dept. IP, 405 Lexington Avenue, New York, N.Y. For more information, circle 745 on READ-N-CIRCLE card on page 47 or 48.



Panel casing on one of several heat exchangers that enable Ford's 486-acre plant to carry on heat treat and welding operations that would be otherwise impossible.



Schematic drawing of typical millwater system that is saving over $29,000 a year on water bills. Reservoir pit has weir to trap any extraneous solid matter. ♦

10¢ worth of SMOOTH-ON *supports* 690 POUNDS!

Smooth-On, with its expanding action and iron-hard set, made the joint which supports the load shown —an ash can loaded with iron filings to a total weight of 690 pounds. Only Smooth-On No. 1 is holding that eyebolt in that pipe!

Hundreds of Uses This principle can be used in dozens of ways around both plant and home. By expanding hard and tight within a repair, Smooth-On IRON Cement stops leaks, fills holes and seams in any metal, patches boilers, repairs water jackets and radiators, corrects wobbly bolts and screws, plugs tanks, holds loose parts tight — in fact, does all kinds of things where that combination of strength and expansion can be used. Smooth-On IRON Cement never tires, or softens from age. Years after a repair is made the Smooth-On will be found harder, tighter, stronger.

Keep Smooth-On No. 1 on hand for that emergency repair. It does not deteriorate. Whenever you need it, just mix and fix. It sets in half an hour, hardens to Rockwell R-70 in 24 hours. And of course there is Smooth-On No. 2, a slower-setting IRON Cement but with the same dependable properties.

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FREE Repair Handbook

New, completely revised 48-page illustrated handbook, shows in detail how to make all the repairs referred to here plus dozens of others. Get a copy from your supply house or write us. Sent postpaid.

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THE IRON CEMENT OF MANY USES

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In brief . . . .

AIEE launches two awards

Two awards were bestowed for the first time during the AIEE Fall General Meeting in Chicago. The first Charles E. Kettering Medal, given jointly by six engineering societies, was presented to Dr. Kettering. This award recognizes "creative accomplishments for the benefit of mankind, including discovery, invention, improvement in designs or processes within the relationship of materials and energy." The first AIEE Member-for-Life Fund Medal was awarded to Dr. Frederick E. Terman, provost and dean of engineering, Stanford University. In addition, the Fall Meeting was highlighted by celebration of the 100th birthday of Nicola Tesla, discoverer of many phenomena fundamental to electrical engineering. From among the many papers presented, INDUSTRY POWER quotes the following:

KETTERING

Engineering in a changing world

F. E. TERMAN, DEAN OF THE SCHOOL OF ENGINEERING AND PROVOST OF STANFORD UNIVERSITY.

"The successful engineer of today has to deal with people and be a part of the world about him. Even the systems that he creates with the aid of mathematics, his knowledge of materials, and from the results of his experiments must be run by human beings and, therefore, matched to them in an appropriate manner. Today, there is universal acceptance of the view that every young engineer must have training in the social sciences and humanities. Gone is the time when, if the freshman engineer passed his matriculation examination in bonehead English, he could happily complete a 4-year program absolutely untouched by such cultural subjects as English, economics, history, psychology, and sociology.

"Although the devices and systems of man are steadily becoming more difficult to understand, the children of men are no different from their parents. This is a basic fact from which there is no escape. Although it is easy to devise fine programs of education which achieve progressively higher goals by expecting each new class to be able to learn a little more in the same length of time, this just does not work out in practice, because the ability of our youngsters to learn new things is the same as that of their parents . . . .

"The character of our rapidly developing technology is such that a young man's initial technical training, however well planned and extensive, is not alone sufficient to carry him through a productive engineering career which lasts a normal life span. Because of this fact, continuing education throughout adult life is a necessity for every engineer who wishes to avoid technological obsolescence. The habit of systematic self study is one of the most valuable qualities a young engineer in industry can develop and is a 'must' for the man who desires to get ahead. In addition, it is popular today to supplement such study by short 1- to 8- week adult training programs or conferences, that sometimes deal with technical material and in other cases with administrative subjects. 'Catch as catch can' learning from on-the-job experience is not adequate for the needs of the future, let alone those of today."

Nickel cadmium batteries in emergency lighting

THEODORE ULRICH, NICKEL CADMIUM BATTERY CORPORATION.

"There has been an increased awareness of the need for dependable and adequate emergency lighting. . . .

"Therefore, batteries used with emergency lighting systems must be reliable and must be capable of being kept in a fully charged condition without loss of capacity. In addition, the battery should require a minimum of attention and be able to withstand prolonged discharges or charges at high current rates without harm. It must be rugged so that it will not be damaged by violent vibration set up by possible nearby explosions. Finally, it must not give off any fumes likely to contaminate the air or corrode other apparatus housed with or near the battery.

"Only the nickel cadmium alkaline battery has all of these necessary characteristics. . . .

"There are four types of emergency lighting

(continues on page 28)

Johnson stays on top

. . . starts on page 14

formed by the operators. Originally, Lockwood did all injector work himself. Later, he taught other men how to do it. All maintenance, now, is handled by other operating personnel.

plant repair pays off

Lockwood is a licensed chief engineer in the U. S. Maritime Service for vessels of not over 1000 horsepower. He is also a licensed second assistant engineer for motor and steam vessels of any horsepower. Much of his experience in operating steam and diesel power plants at sea has been applied to his job. Lockwood is an experienced welder and has trained his operators to hardface valves with cobalt-steel alloy and to grind to finished contours. At present, two-thirds of all valves in use have been hardfaced by plant personnel.

As another example of economic maintenance practices, he purchased a cylinder hone for $130.00 with all accessories. Cylinders that are not scored or cupped beyond tolerance limits are honed in the plant. One man-day is required to hone each cylinder. Lockwood figures that even after several honings, liners are still acceptable to treatment such as is obtainable from Van der Horst Corp. of America. Lockwood has also purchased two pneumatic wrenches to speed maintenance. Jobs that formerly took 24 man-hours can now be performed in 8 man-hours.

During 1955 the Johnson plant was delivering power to 18,444 customers. Year-end totals showed that Johnson delivered 72 percent of Wolverine's net system generation of 63,979,235 kwh. At times, the Johnson plant was called upon to carry a 10,200-kw load. Rated capacity is 10,065 kw.

An important factor in Johnson's economic operation is the fact that the plant operates at a nearly constant load. Three other plants in the system cooperate to carry peak loads and to carry normal load when engines at Johnson need repairs. These other plants are: Bestaburg plant, Bestaburg, Michigan; Winder plant, Portland, Michigan; and Van Dyke plant, Burnips, Michigan. Part of the credit for Johnson's string of victories should be given to the operating staff at each of these plants

Delbert Roggow, maintenance operator, completely reconditions all fuel injectors on precision grinder.

DAILY SUMMARY AND PERFORMANCE LOG

PLANT **JOHNSON PLANT** DATE 7-26-56

Unit No	Size HP	Size KW	Hours Oper. Today	Gross KWH Generated	Fuel Used Oil Gals.	Fuel Used KWH/Gal.	Fuel Used Gas MCF.	Fuel Used CF/KWH	Lube Oil Gals.	Lube Oil HPHrs/Gal.
1	1010	700	10 8	5570	181	46	84.3	741		
2	1010	700	16.1	8086	127	63.6	67.0	8.3		
3	1650	1165	20.7	16070	932	47.0	105.2	6.55		
4	3500	2500	23.7	43 000	2.11	2040	371.2	8.6		
5	3500	2500	17.3	36700	2054	17.3	84.6	2.34		
6	3500	2500	24.0	48900	203	191	397.0	8.1		
7	0000	0000			3958		1066.3			
8										
9										

Fuel Tank Soundings - Start of Day No.	Ft.	In.	Gals. by Chart	Temp.	Deg. API	Corr. to 60°F	True Gals.
1							
2							20908
3							
4	4	1¾	7965				7089
5							
6							
7							
8							
Grav.							1015

Total Gross Generated KWH	157 320
Station Service - KWH	
Net Generation - KWH	
Sta. Service - % of Gross	

Factors	Max. Demand KW
Load	
Plant	Ind.
RPC	15 min. 5400

KILOWATT HOUR METER READINGS

Meter	Today	Prev. Day	Diff.	Mult.	KWH
Totalizer No. 1					
" " 2					
Total					
Plant Use No. 1					
" " 2					
Total					

Net KWH Delivered to Transmission Lines

DISTRIBUTION FEEDERS - KILOWATT HOUR METER READINGS

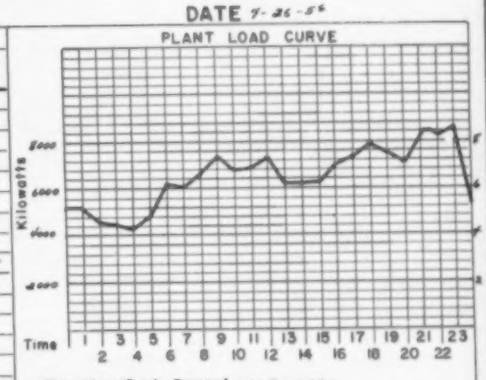
NO	TO	TODAY	PREV. DAY	DIFF.	MULT.	KWH
1						
2						
3						
4						
5						
6						
7						

Total on Hand - Start of Day	25956
Received Today - Inv. No.	
" " Inv. No.	
" " Inv. No.	
" " Inv. No.	
" " Inv. No.	
" " Inv. No.	
" " Inv. No.	
Total on Hand and Received	25956
Total on Hand - End of Day	25708
Total Used Today	248
Total Fuel Oil Metered Today	
Total Gas Metered Today	

LUBE OIL RECORD

On Hand - Start of Day	1625
Received Today - Inv. No.	
" " Inv. No.	
" " Inv. No.	
Total on Hand and Received	
Total on Hand - End of Day	
Total Used Today	

PLANT LOAD CURVE



Time Max. 15 min. Demand 2105 - 2140

LABOR	Hours S.T.	Hours O.T.	Wages	MAT. COSTS
Operation				
Maintenance				
Totals				

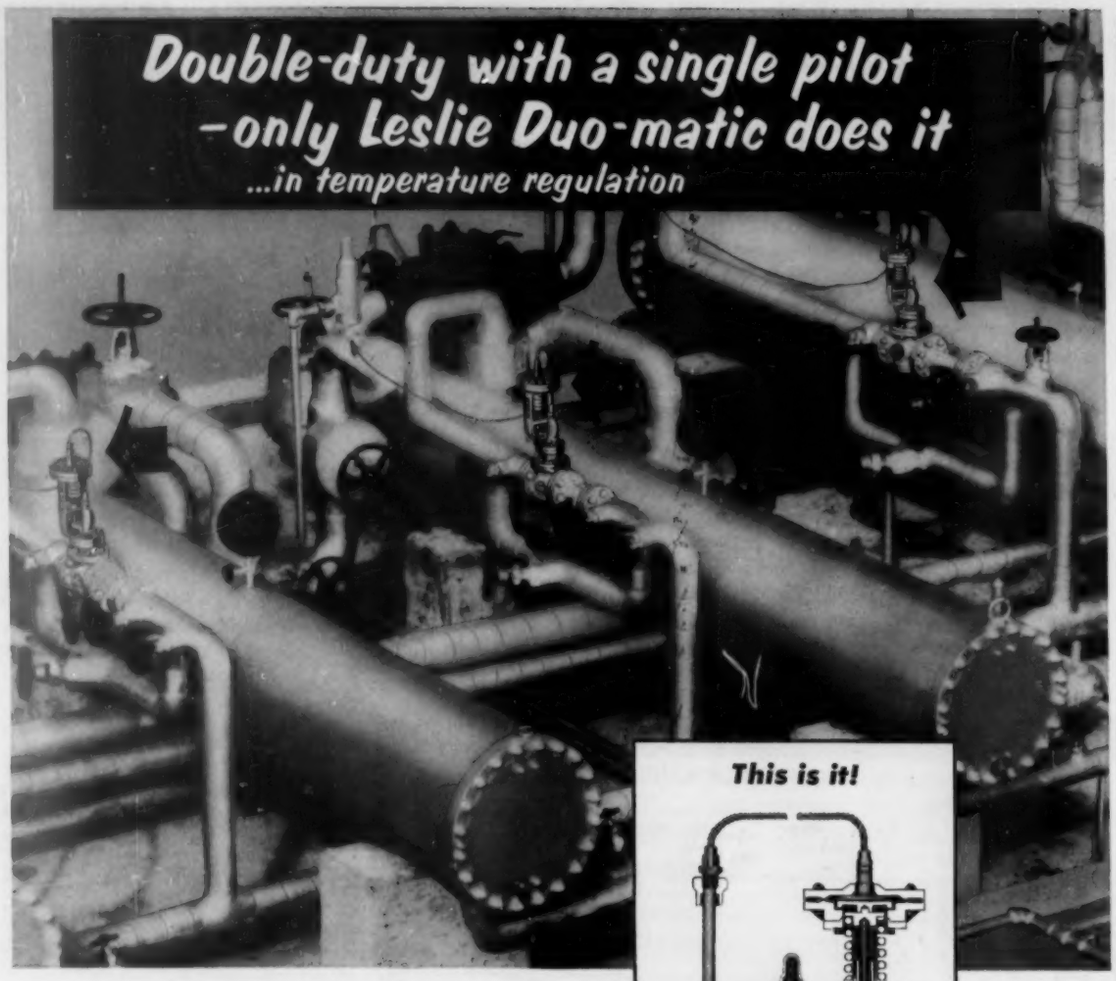
PLANT OUTAGES

Time	Duration	Remarks

MATERIAL RECEIVED TODAY

Inv. No.	From	Value

Fig. 1—Daily operating data is recorded for each engine on master sheet. Discrepancies in day-to-day operating efficiencies are noted and inspection planned.



The Duo-matic Leslie temperature regulator for controlling steam flow is a single unit, with a *single* internal pilot valve—yet it controls automatically both temperature and pressure conditions. No hunting or cycling on low flows . . . eliminates temperature "droop" on heavy loads.

Simplified piping and better control of fuel oil heaters, instantaneous and storage type heaters, driers, process heaters, kettles, open tanks, ovens, degreasing machines, steam tables, sterilizers, etc., more than offset the initial cost of this superior regulator.

Investigate "dual-function" Duo-matic regulators — proven in service for over 19 years of applications.

Leslie Class LTCO Duo-matic temperature and pressure regulator

Write for Bulletin 5307

TRADE LESLIE MARK

REGULATORS AND CONTROLLERS

LESLIE CO., 263 GRANT AVENUE, LYNDHURST, NEW JERSEY

Circle 123 on READ-N-CIRCLE card for more data

for their teamwork in maintaining steady load conditions for Johnson.

In generating 47,512,910 kwh in 1955, Johnson plant consumed 240,892,900 cu ft of natural gas and 1,584,461 gal of fuel oil. With gas at 1010 Btu/cu ft and fuel oil at 138,532 Btu/gal this represented a fuel heating value of 9733 Btu/kwh produced.

fuel oil and gas vary

Fuel oil for Wolverine is a constant problem. Fuel oil, including transportation costs, is expensive in North Central Michigan. In 1947, 37-degree API fuel was available. At the present time, 30-degree API fuel oil is being burned. This variation in available fuel oils plus the irregular fuel gas supply make high efficiency quite difficult to attain. Long-range planning is difficult when fuel oil prices fluctuate.

Fuel gas supplies from local gas fields have been

PRINCIPAL PLANT EQUIPMENT

Engines	Three Fairbanks-Morse 10-cylinder, two-cycle, 3500-hp 277 rpm Model 31AD18, dual-fuel engines. Two Cooper-Bessemer 1010-hp, Model JS-8-T, dual-fuel engines. One Cooper-Bessemer 1650-hp Model LS-8-GDT, dual-fuel engine.
Governors	Woodward Governor Co.
Blowers	Roots-Connersville driven by Fairbanks-Morse motors.
Turbochargers	Elliott Buchi
Air filters	On F-M engines. Continental Self-cleaning. On C-B engines. Air Maze.
Jacket water pumps	On F-M engines. Fairbanks-Morse & Co. On C-B engines. Allis-Chalmers.
Raw water pumps	Fairbanks-Morse
Lube oil	Texaco Ursa 1623. The Texas Co.
Cylinder lubricators	Madison-Kipp Corp. On F-M engines.
Aux. lube pump	Blackmer Pump Co., Inc. On F-M engines.
Lube filters	Cuno Briggs Filtration Co. Hilco. The Hilliard Corp.
Lube reclaimer	U.S. Hoffman Machinery Corp.
Fuel filters	On F-M U.S. Hoffman Machinery Corp. Wm. W. Nugent Co., Inc.
Exhaust pyrometers	Alnor. Illinois Testing Lab., Inc.
Starting air compressors	Quincy Compressor Co. Ingersoll-Rand Co. Cooper-Bessemer Corp.
Exhaust snubbers	Burgess-Manning Co.
Battery	Exide
Circuit breakers	Pacific
Injection nozzle grinder	Merlin
Nozzle tester	Fairbanks, Morse & Co.
Bearings	On F-M. Federal Mogul On C-B. Cooper-Bessemer Corp.
Consulting Engineers	J & G Daverman Co., Grand Rapids, Mich.

scarce and irregular. Keen and the Wolverine board of directors have encouraged development of local gas fields at every opportunity. Entire gas output of many wells is contracted even before the wells are drilled.

Fuel gas also presents problems to chief operator Lockwood. Depending on the amount of fuel gas available, he selects the engines that operate most efficiently on fuel gas to carry the heaviest load. Matching engines to fuel supply, like a gigantic game of chess, is a game that Lockwood enjoys. Fuel costs determine to a great extent how operations will proceed.

Secret of Wolverine's economic operations lies simply in the two time-proven principles of shrewd bargaining and efficient use of engine downtime by experienced maintenance crew. Based on past performance, and under the same guidance, it appears that Wolverine will continue to set the pace for all REA internal combustion generating stations. ♦ ♦

O-P diesel for standby

WHEN BASIC LOAD increased, Ohio Bell Telephone Company's Canton-Glendale exchange recognized that standby power capability must increase to keep pace.

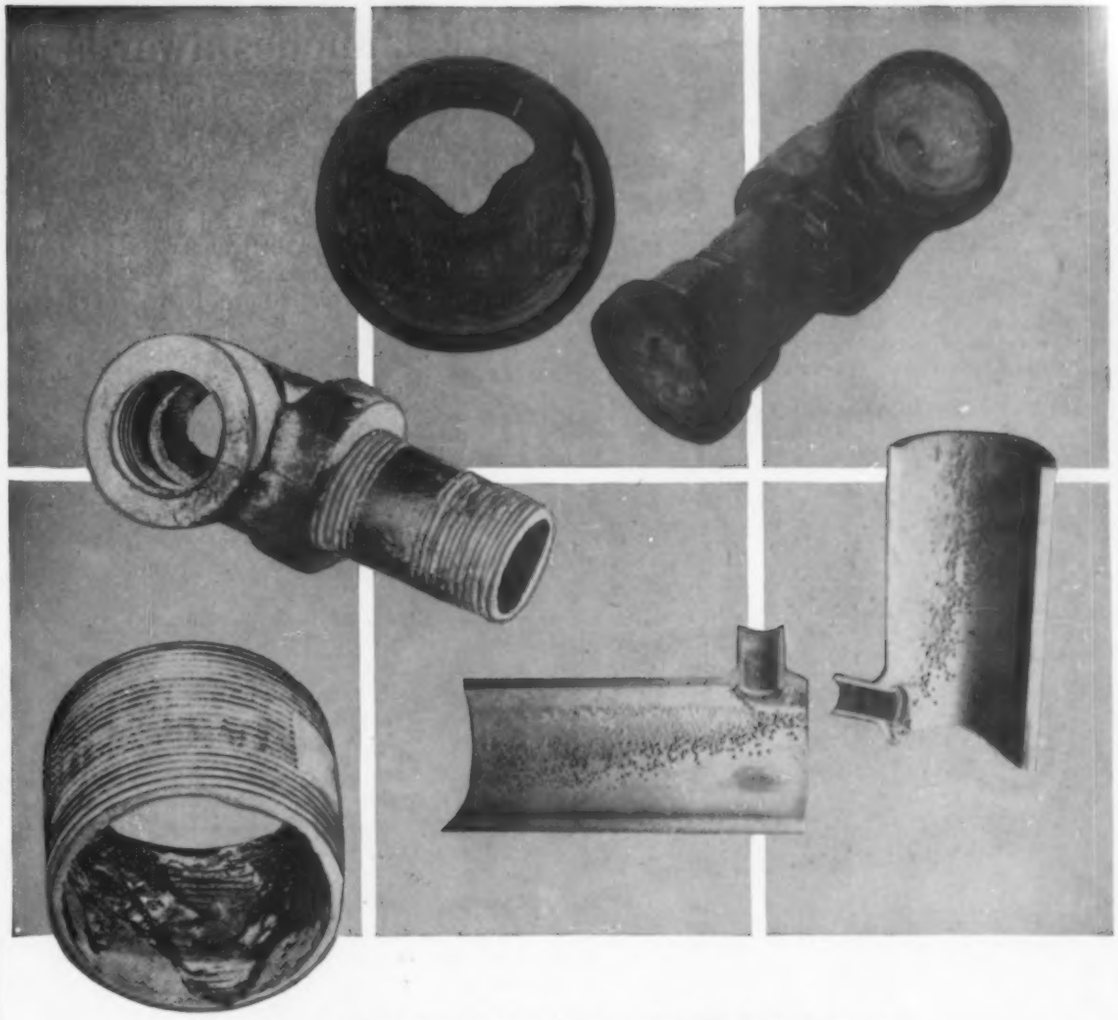
Existing standby protection consisted of two 60-kw diesel-generator sets plus storage batteries capable of supplying a 3-busy-hour reserve for telephone equipment. Batteries were able to carry existing telephone load and emergency 48-volt lighting, but were not able to supply any other building needs. Diesel-generator sets were not able to supply sufficient energy to operate telephone equipment.

Several factors led to decision to install another diesel-generator unit. Minimum space would be required. Factory mounting on steel subbase meant diesel generator could rest on basement floor without extensive building modifications. Unit selected was a Fairbanks-Morse Model 38F5¼, 525-hp, 1200-rpm opposed-piston diesel, direct-connected to an F-M Type TGZJ 350-kw alternator with direct-connected exciter. Diesel-generator produces 120/208-volt, 3-phase, 60-cps current.

New unit generates enough power to carry all present essential lighting and building power plus present telephone load with adequate reserve for anticipated increases.

Engine fuel is stored in a 1500-gallon tank under a sidewalk behind the building. Fuel flows by gravity from day tank to an engine-mounted rotary gear pump which supplies oil to the injection pumps.

Important consideration to Ohio Bell Telephone Company is that separate power sources will insure uninterrupted service to the community. Beyond this, standby capability is keeping pace with basic load. ♦ ♦



WHAT'S YOUR TROUBLE?

Each of these destroyed parts had to be taken out of service because of incomplete or inadequate water treatment. Replacement meant loss of steam production . . . new equipment expense . . . added labor-repair costs.

DEARBORN COMPLETE WATER TREATMENT SERVICE eliminates this by providing trouble-free water—a vital necessity to every user of industrial steam. Dearborn's many years of leadership in the field of water treatment will help keep your power plant operating economically.

CALL ON YOUR DEARBORN SALES ENGINEER for (1) analysis of raw water (2) recommendation of test procedures (3) proper treatment (4) a manually or automatically controlled feeding system.

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☐ Filmeen Bulletin 5013-A
☐ Dearborn "659" Bulletin 5008
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City..... Zone..... State.....

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Ever looked in your reference file for specific information when you needed it—and found a void. Or perhaps you found *some* material, but not the right kind. We *all* have. Well, here's a chance to be sure you have a *lot* of information on one subject, at least—heat processing.
This new 20-page MOCO "Fact Book" is crammed full of basic heat processing information you'll refer to time-and-again. Its prepared by MOCO Engineers—men who specialize in *only* industrial ovens. Write for your copy today (on your letterhead please). We'll send it along immediately.

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Manufacturers of Industrial Ovens For Every Plastic Application
411 Brainard, Detroit 1, Michigan

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AIEE launches awards

. . . starts on page 24

systems utilizing nickel cadmium batteries. These are:

"1) Individual battery-powered units.

"2) Centrally located battery-powered control units.

"3) Battery-cranked, engine-driven generator sets.

"4) Switchgear control batteries with auxiliary emergency lighting. . . .

"There are certain safety features which only the nickel cadmium alkaline battery possesses. Unlike lead-acid batteries, no corrosive fumes are given off during charge or discharge. The battery, therefore, can be enclosed in a lighting unit, without fear of corrosion of the cabinet or other apparatus housed therein.

"Unlike the nickel iron alkaline battery, the nickel cadmium battery may be kept in a fully charged condition without gassing the electrolyte. Therefore, very little water is consumed provided the battery is trickle charged at the proper voltage. The addition of water is infrequent, reducing maintenance to a level impossible with other types of storage batteries.

"Should there be occasion to mothball any emergency system operating with nickel cadmium batteries, it is possible to store the battery in the condition in which it is removed from service. No trickle charge or periodic high rate charges are required to prevent deterioration of the active materials while the battery is in storage. It is advisable, however, to disconnect the battery from the charging source and, in the case of high-voltage batteries, to remove one or two intertray connectors to prevent stray current leakage. Even after one year on open circuit at normal temperatures, the nickel cadmium battery will retain 50 percent of its charge."

Using aluminum-sheathed cable

PHILIP J. CROFT, CANADA WIRE & CABLE CO., LTD., TORONTO, ONT.

"Handling and installation of aluminum-sheathed cable in utilization wiring systems do not involve any unusual or new techniques, save possibly the special technique required for wiping, when wiped joints and pothead entrances are required. These methods . . . . are already widely known. The principal 'special' requirement upon the electrician is that he accustom himself to the 'feel' of aluminum-sheathed cable, which is much lighter than lead-sheathed cable, and, naturally a good deal less flexible than flexible armored or nonmetallic-sheathed material.

"Aluminum-sheathed cable in industrial wiring systems is run in from wooden reels in the normal manner, and if of large size, may be supported in temporary scaffolding, from which it is transferred loosely to its permanent supports, and straightened before tightening the supports. For all except the largest diameter cables, straightening may be simply accomplished by tapping with a rubber or rawhide mallet against a length of 2-by-4 timber. For very large cables, a mechanical straightening device is available."

Protecting ac motors

F. P. BRIGHTMAN, P. J. REIFSCHNEIDER, R. R. MCGEE, GENERAL ELECTRIC COMPANY.

"Broadly speaking, there are two periods in the operation of motors when overheating protection is needed: Normal-running-overload condition; stalled-rotor condition. . . .

"Under the heading of running-overload protection, the motors can be divided into three classes having definite ASA and NEMA Standards for temperature rise; namely:

"1) 50 C continuous, with no service factor.

"2) 40 C continuous, with 115 percent service factor.

"3) 55 C continuous, with no service factor (enclosed motors).

"According to NEMA Standards, these temperature rises are based on an ambient of 40 C. These recommended temperature limits have been adopted as industry standards for Class A insulation on the grounds that insulation operating at the total temperature permitted would have a long-life expectancy. In this connection, the ques-

AIEE Pres. M. S. Coover presents Member-for-Life Fund Medal to Dr. F. E. Terman, Stanford Univ.

tion of the probability of the occurrence of moderate overloads is an important factor in evaluating the effectiveness of protection afforded by the series-trip devices. Certain types of loads, such as centrifugal pumps and fans, are not likely to be overloaded—assuming that the motor was properly selected for the application. On the other hand, reciprocating pumps, conveyors, machine tools, coal pulverizers, crushers, etc., can impose overloads of moderate magnitude which may not be easily detectable by the operator. . . .

"A motor rotor may stall either during starting or running due to extreme overload, low voltage, or freezing of the bearings, etc. When stalled, the motor draws symmetrical locked-rotor (initial starting) current for the duration of the stalled condition. Since stalled-rotor is an abnormal condition, which is not expected to happen very often, the rotor temperature is allowed to go considerably higher than for normal running conditions. There are no accepted standards for the maximum permissible temperature rise permitted on the motor stator or rotor (whichever is the limiting item)."

Experience in terminating aluminum industrial wire and cable

HENRY ESCH, CHIEF ELECTRICIAN, NEWARK WORKS, KAISER ALUMINUM & CHEMICAL CORP.

"Use of aluminum wire in industrial plants is not new. Some of us have been using it for years, and many more would be using it if it were not for lack of information, use of improper terminations, and reluctance to change on the part of the craftsmen.

"Necessity for proper terminations exists whether copper or aluminum wire is used. A bad connection spells trouble in either metal. A poor connection with copper is recognized as such, whereas with aluminum, the metal itself is apt to be blamed.

"The first rule in using aluminum is to realize that it is not copper. Most of the trouble with aluminum arises when it is connected in the same manner as copper. If a job is to be installed with aluminum, it must be engineered for it. . . .

"With proper planning . . . . an aluminum job equally successful to any copper installation will result. Furthermore, the ease of handling this lightweight metal reduces labor cost. ♦ ♦

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. . . see page 53

Coal . . . low in sulphur
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Coal . . . HIGH in btu's
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For dependable deliveries of top quality coals, contact coal producers on the C&O. And if you need help in meeting your own particular fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway
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STEAMLINED!
to heat water fast, at low cost

In the Johnson Heater, water to be heated is routed first inside, then outside, a blanket of live steam. It's full pressure steam, too; up to 150 lbs., or 250 lbs. in heavy duty types, no reducers are needed. The result: faster, more efficient heat transfer for a unit of its size. No wonder industry has found so many applications for the Johnson "Instant" Heater, in heating water and process liquids of various types.

JOHNSON "Instant" HEATER

Sizes for all needs; write for literature

The Johnson Corporation
807 Wood St., Three Rivers, Mich.

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Steam-power modernization

. . . starts on page 12

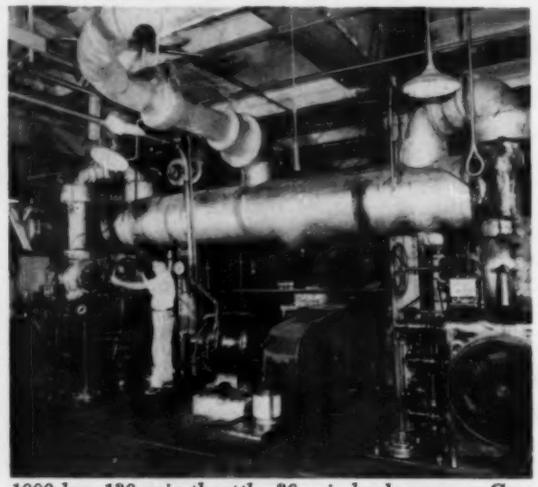
Continuing load growth is forcing modernization at the Rothschild plant, as is true of most industry. Expansion offers opportunities to modernize for even greater economy in generating existing power needs. Rothschild Plant's 600-psig turbogenerator operating at 300 psig generates about 1200 kw with a throttle flow of 52,000 lb/hr. All this steam is exhausted at 33-psig backpressure and 25 F superheat for mill process. By way of comparison, the old Corliss engine generates about 1000 kw with 50,000 lb/hr flow at 130-psig throttle pressure and 30-psig exhaust.

Operating on 600-psig, 750 F steam next summer, the turbogenerator will deliver 3500 to 4500 kw with throttle flow from 60,000 to 90,000 lb/hr — depending on process demands for the exhaust steam. So go the prospects for Marathon's steam system as presently built and authorized at Rothschild.

operate hydro plant, too

Rothschild Plant, located on the Wisconsin River, operates its own hydro station. Original Leffel wheels, installed in the early 1900's, still operate satisfactorily. Peak capacity at full river flow totals 3800 kw.

Present electric load at Rothschild averages 9000 kw. An average 2400 kw is available from hydro with normal river flow. The 600-psig turbogenerator running at 300 psig produces 1200 kw. This means 5400 kw is purchased from the local utility. When the turbogenerator goes on 600-psig steam, purchased power will be cut to about 2600 kw. Even assuming that some creeping load growth will raise power needs in the meantime, the change to rated pressure on the turbogenerator will cut purchased power by half. Coal consumption with the new boiler generating at 600 psig will be no greater than at present due to better boiler efficiency. This 600-psig steam generation, coupled with reduced maintenance and repair plus more efficient fuel utilization, accounts for the $200,000 annual savings Marathon expects. (New boiler and auxiliaries cost approximately $500,000.) These savings are based on the new boiler and turbogenerator combination. Having the turbine installed, economics of the boiler are good. At the same time, dependability of the steam and electric supply is greatly improved — an improvement vital to 24-hour, 7 day/week paper manufacturing operations.



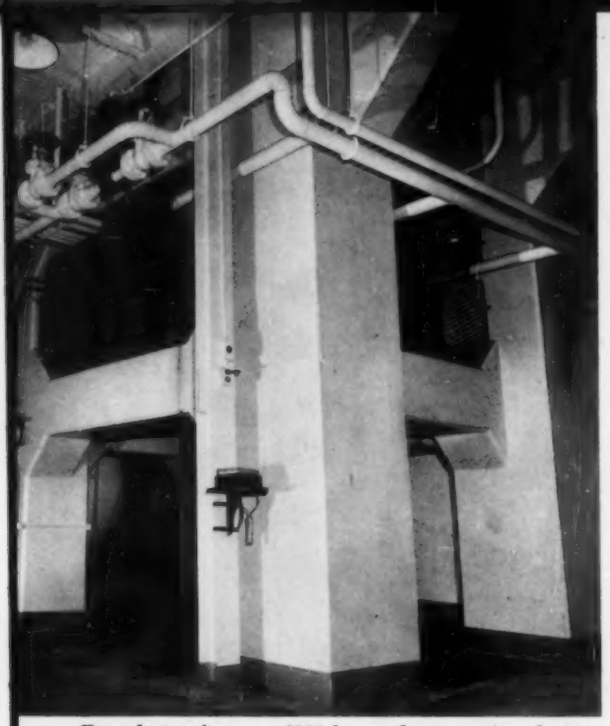
1000-kw, 130-psig throttle, 30-psig backpressure Corliss engine now is operating on standby service.

A double-barreled installation advantage was gained by erecting the turbogenerator building on an unused pumphouse foundation. First, there was no room in the boilerhouse area and the abandoned pumphouse offered a suitable foundation that was available with a minimum of extra out-of-pocket cost. Second, and far more important, exhaust steam could be transported more economically because the location is nearer the process steam load center than the boilerhouse area. Steam is transported at high pressure by a 750-foot, 600-psig line to the turbogenerator. Exhaust steam for process, at 33 psig, has less than 100 feet to travel from turbine to center of process load.

Pulp surrounds new 1000-kva, 4160/480-volt substation, part of new high-voltage primary system.

electric distribution keeps pace

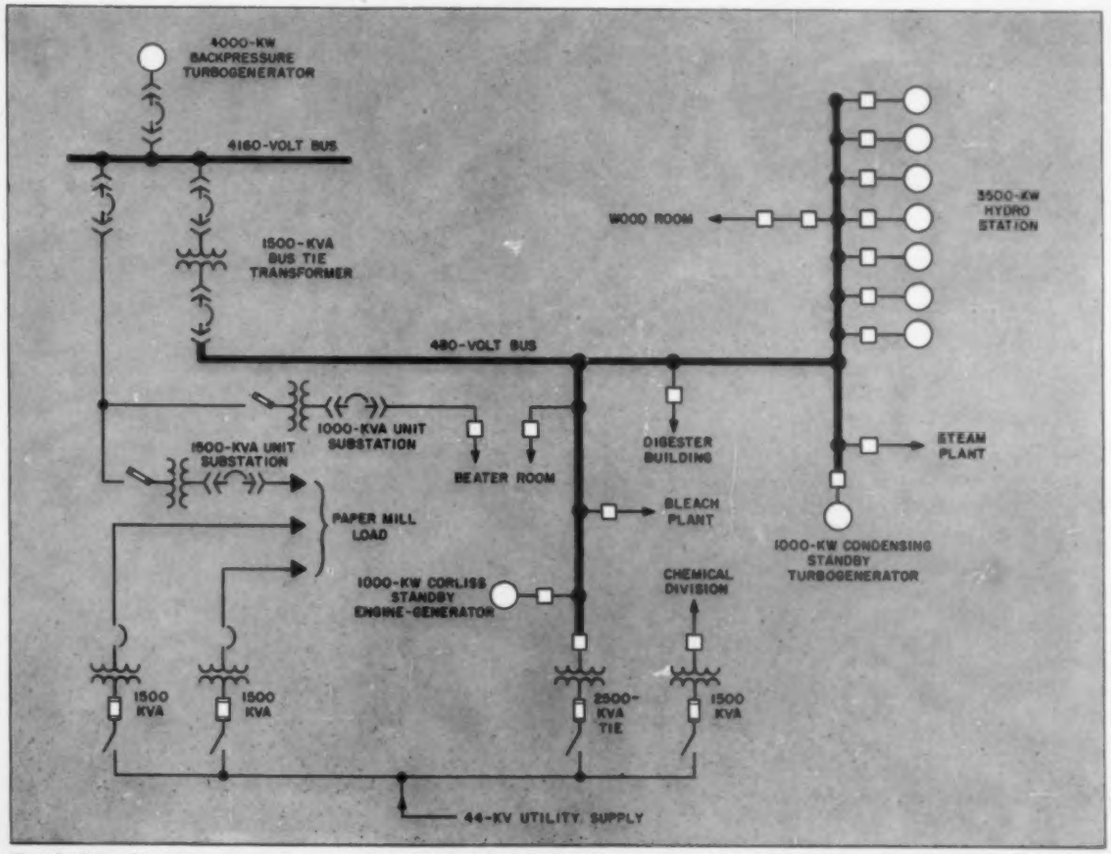
Keeping pace with this modernization program, the plant-wide electric distribution system is being updated in step with the steam generating system.



Foundation for new 4000-kw turbogenerator, designed by Marathon engineers for existing pumphouse.

Corliss engine and hydro plant generate 3-phase power at 480 volts. This was the distribution voltage for the plant. New turbogenerator is rated 4160/2400 volts at 3600 rpm. A modern 4160-volt radial primary system is being backboned over the existing 480-volt network. All new load is picked up through the new primary system. Existing load is being transferred as new transformer capacity is installed in each plant manufacturing area.

So having a master plan, Marathon is completing a modernization program in steps that can be economically justified and that will give a well integrated system when complete. Subsidiary benefits pay off along the way even before the total effects of the modernization take place. For example, need for better boiler makeup water at 300-psig pressures demanded more complete water treatment. This treatment equipment, installed and awaiting completion of the high-pressure steam system that demanded it, is paying for itself already by eliminating the expensive mechanical boiler tube cleaning that had come to be expected as "normal." Marathon is finding that in many similar ways, today's steps in modernization can be made to anticipate tomorrow's .... and yet modernization pays off today. ♦ ♦



Single-line diagram shows how some portions of the plant have already tied in to new high-voltage primary.

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From raw material to final inspection every part is MADE and ASSEMBLED under our own quality control.

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Jamestown, New York

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the spiral conveyor of dependable service. Used on incline or horizontally.

Mechanically handles materials from grain size to lump . . . sand, rice, seed, pellets, flakes, steel chips, wood waste, coal, etc.

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SIMPLEX DUPLEX

STEAM or POWER models for any need

TYPICAL MATERIALS PUMPED:
ACIDS, ALCOHOLS, BEER & POTATO MASH, DYES, GLUE, OIL (any kind), ASPHALT, BRINE, MILK, MOLASSES, SOAP, SEWAGE, WATER, TAR, GROUT

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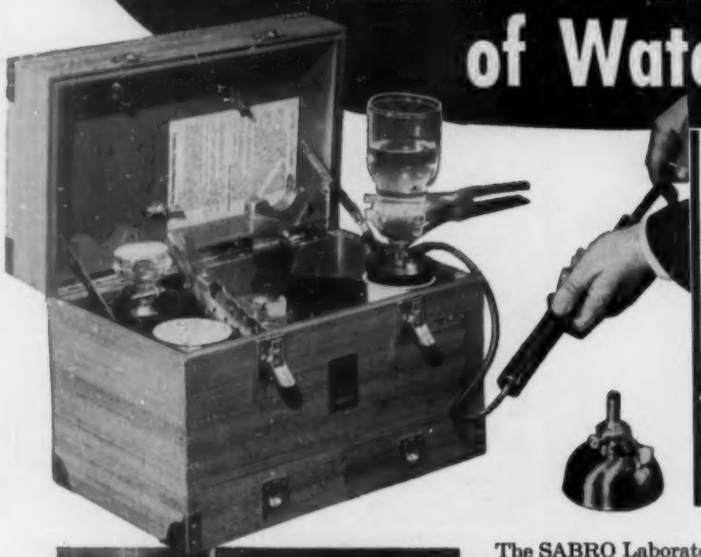
Fast, economical, and accurate

Bacteriological Analysis of Water



with the SABRO Portable Laboratory

The SABRO Laboratory for Water Bacteriological Analysis, portable and utilizing the modern membrane filter technique, does the entire job of bacteriological water testing rapidly, accurately, economically, and without the need for highly skilled lab technicians. SABRO simplifies the new membrane filter technique by using special dehydrated nutrients, and guarantees uniformly good results.

The steps are simple

1. Connect power source and check incubator temperature.
2. Flame sanitize glassware and forceps.
3. Transfer sterile membrane filter with forceps from culture can to funnel holder.
4. Rehydrate nutrient pad in the culture can with sterile distilled water.
5. Filter measured water sample through membrane, using SABRO vacuum pump.
6. Transfer membrane filter to culture can with sanitized forceps.
7. Close culture can and record test data on lid label.
8. Incubate culture.
9. Examine test results.
10. Treat test results for permanent record.

Write today for complete Sabro description and prices.

Hyla process

SALEM-BROSIUS, INC.

Arch Street Carnegie, Pennsylvania

Circle 150 on READ-N-CIRCLE card for more data

Properties of atmospheric air

. . . starts on page 20

$$m_{a1} = \frac{P_a V_1}{RT_1} = \frac{14.47 \times 144 \times 1000}{53.35 \times 540}$$

$$= 72.4 \text{ lb/min}$$

From the psychrometric chart we find that $h_1 = 30$ Btu/lb of dry air and $h_2 = 38$ Btu/lb of dry air.

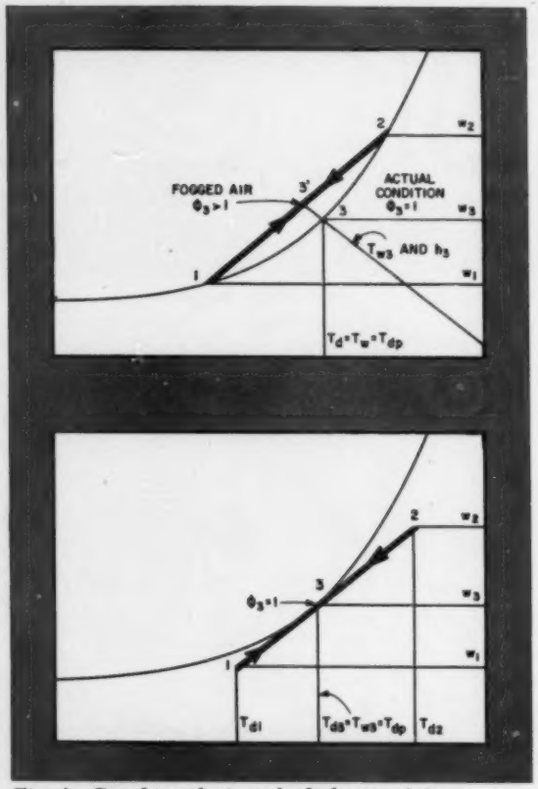


Fig. 4—Graphic solution of adiabatic mixing process when final state is fogged (top), and saturated air.

From Eq. (12) we get

$$\frac{m_{a1}}{m_{a2}} = \frac{h_3 - h_2}{h_1 - h_3}$$

$$(h_3 - h_2) = \frac{m_{a1}}{m_{a2}}(h_1 - h_3)$$

$$(h_3 - 38) = \frac{72.4}{35.2}(30 - h_3) \text{ Btu/lb}$$

$$h_3 = 32.6 \text{ Btu/lb dry air}$$

(b) Point 3 can now be located on straight line joining points 1 and 2. Dry-bulb temperature of the mixture at point 3 is $T_d = 83.2$ F.

(c) Wet-bulb temperature is $T_w = 69$ F.

(d) Relative humidity is 49 percent. ♦♦

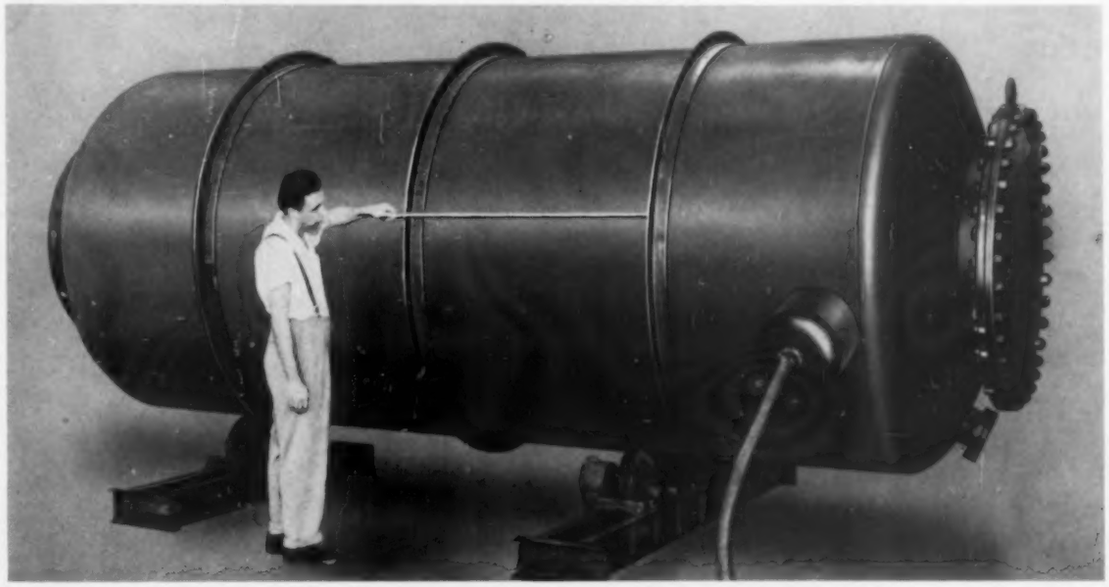
new products

. . . just circle key numbers on READ-N-CIRCLE card on pages 47 or 48

700-Purifier conserves water and steam

High-efficiency purifier cleans low-pressure steam without moving parts, filters, or mesh screens. Purifier uses new patented two-stage separation principle. Controlled centrifugal force guides steam through a series of vanes and baffles. First separation stage makes steam impinge against baffles to remove large droplets. Second separation stage removes remaining mist entrained in the steam by centrifugal action in a separation element.

Steam and separated material are carefully guided for maximum efficiency. Purifier is installed in low-pressure steam lines on exhaust side to remove oil, pipe scale, and other impurities. Unit reduces raw boiler feedwater requirements, and retains much heat in the water. Units are made in a wide range of sizes, to handle up to 42,000 lbs/hr of steam. The V. D. Anderson Company, Division of International Basic Economy Corporation.

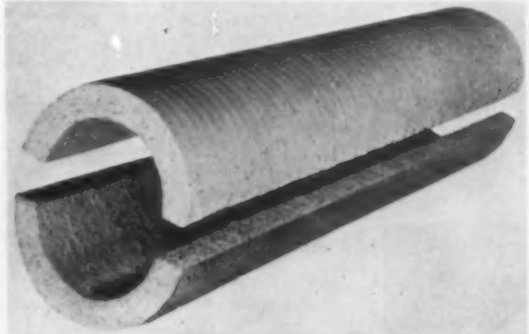


701-Fuel additive cuts engine wear

New diesel fuel additive increases diesel engine operating efficiency. Additive consists of compounds that are completely combustible with diesel fuel. It is nonexplosive, nonpoisonous, noncorrosive, and will not effect diesel fuel cetane rating or efficiency. Eliminates injector clogging and aids proper and complete combustion. Inhibitors minimize corrosive acid formation and prevent polymerization of gums and varnishes. Keeps fuel tanks and lines clean. Harflo Products.

702-High-temperature pipe insulation

New high-temperature range molded insulation withstands pipe temperatures up to 1350 F. Material is produced in half-cylindrical sections and segments 36-inches long. It can be cut easily and works with ordinary tools. Insulation is available in thicknesses from 1 inch to 4 inches and will accommodate pipes up to 33-inches od. Stable insulating material is flame-resistant and chemically inert, as well as being insoluble in water.

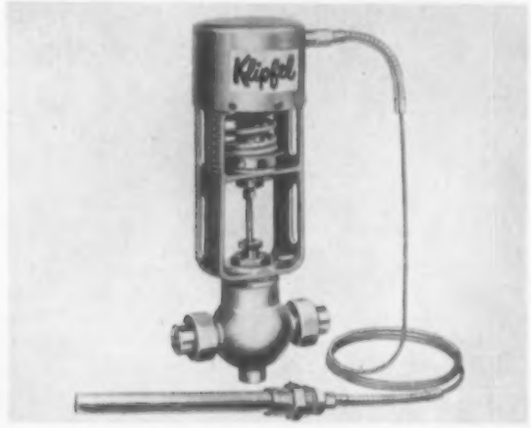


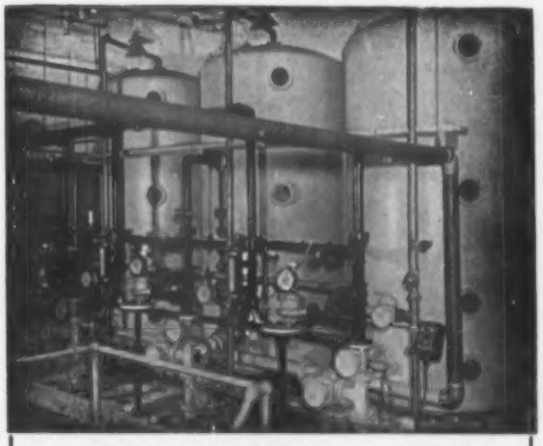
Compressive strength permits it to be laid over irregular shapes, bolts, and depressions and held tightly without breakage. Keasbey & Mattison Company.

703-Regulator uses vapor pressure

Self-actuated vapor pressure temperature regulator provides accurate, positive, low cost control. Regulator can be used for control of hot water tanks, instantaneous heaters, oil treaters, oil preheaters, as well as cooling systems for diesels and compressors. Regulator is completely self-actuated. It requires no compressed air, water, electricity or other auxiliary power for operation. Bellows overheat protection provides against damage when bulb is accidently subjected to temperature in excess of range. Adjusting scale permits quick repeat setting of control temperature. Klipfel Valves, Inc.

(more new products on page 34)





18,000 GPH H&T UN-A-BED DEMINERALIZER PLANT

. . . a typical H&T installation

Since 1943, we've been building demineralizer plants. All sizes, all capacities — manual or automatic available. Highest quality, attractive prices, fully guaranteed. Hundreds of units in service.

Also a complete line of other water conditioning systems.

Write for details.

H&T SERVICE

HUNGERFORD & TERRY, INC.

CLAYTON 1, NEW JERSEY

Circle 149 on READ-N-CIRCLE card for more data

Now *simpler, more accurate control of oxygen in*

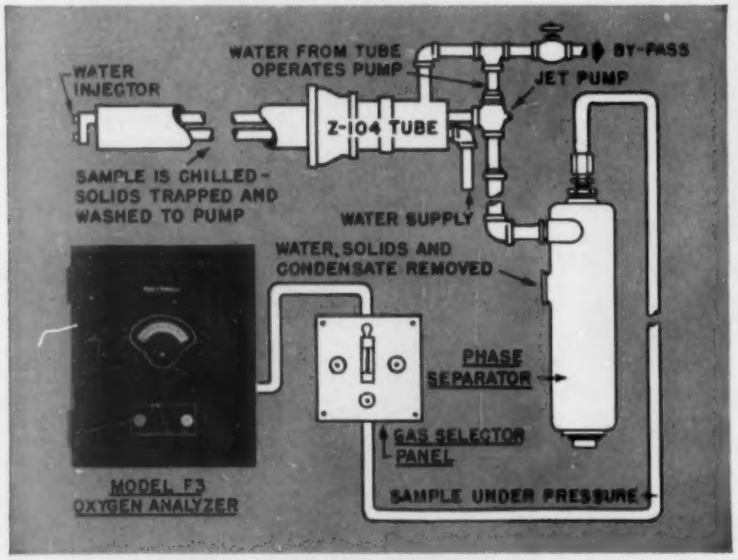
BOILERS...FURNACES...KILNS...DIRECT-FIRED HEATERS, ETC.

with Arnold O. Beckman INC.

complete Analysis Systems!

Arnold O. Beckman, Inc. – leaders in developing advanced instrumentation for accurate oxygen control – now offers *complete* analysis systems for higher combustion efficiencies at lower fuel costs.

These field-proven systems are already being used by progressive operators to boost profits, cut costs – and they will make the same savings for *you*. They consist of Analyzer, and Sampling System – all in one compact installation suitable for indoor or outdoor location. For severe temperature conditions, heated cabinets can be supplied.



The diagram (above) shows a typical analysis system for boilers. The incoming sample gas is first chilled and washed . . . then passes through a Separator where the condensables and solids are removed. The resulting clean, dry sample gas flows under pressure to the Gas Selector Panel (for selecting "Zero," "Span" and "Sample" gases) . . . then into the Analyzer where the oxygen content is quickly measured. The Analyzer may be used with any standard recorder or controller.

Result – new speed, simplicity and accuracy in controlling air-fuel ratios, with important savings in fuel and operating costs!

Get the full story on these Complete Analysis Systems by writing for Data File #19C-116

Arnold O. Beckman INC.
ANALYZERS
Profit Builders for Industry
1020 Mission Street
South Pasadena, California

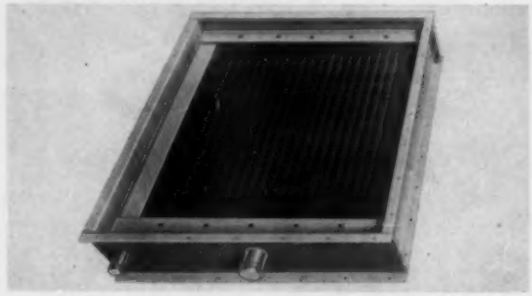
Circle 121 on READ-N-CIRCLE card for more data

new products

. . . starts on page 33

704-Steam coils have built-in drainage

Heavy-duty steam coils are specially tilted to insure condensate drainage when used in either vertical or horizontal position. Coils are tilted in casing to permit full drainage to condensate outlet. Coils are available with



inlet and outlet on same or opposite ends. They are designed so that every square foot of face area produces equal heating capacity on full or modulated steam supply. Sizes range from 12- to 48-inch face height and from 24- to 120-inch width. REMPE CO.

705-Breakers offer visible disconnect

New concept of panelboard design uses compact modular design molded-case circuit breakers for power distribution busses up to 600 amperes. Used with standard metal-clad panelboard enclosures, complete assemblies are quickly and efficiently erected on site. Design flexibility eliminates custom-built panelboards resulting in saving of time and material. Assembly of breakers and bus enclosures has been reduced to a simple mechanical task by means of the new plug-in breakers. Breakers can be removed quickly and replaced by other units of the proper type when modification is required. Four power distribution panel assemblies are available. Each unit has lugs for 225-, 400-, and 600-ampere connections and all panel units are complete with neutrals.

StABreaker line provides a new visible plug-in type of industrial circuit breaker panelboard that conforms to industry-wide standards. Minimum inventory of standard StABreakers provide maximum flexibility in ratings from 15 to 225 amperes at 600 volts with only two general-purpose enclosures in the electrician's crib. FEDERAL PACIFIC ELECTRIC CO.

LOWER TUBE ROLLING COSTS with **AIRETOOL**

AUTOMATIC RETRACTIVE TUBE EXPANSION CONTROL

Save time . . . roll uniform, tight joints with this AIRETOOL method of controlled expansion for installing high pressure tubes in thick tube sheets. Just set the control . . . insert expander and start the motor! When full expansion is reached, expander automatically retracts, drawing metal toward mouth of tube. Prevents elongation, distortion or enlargement of holes. Eliminates costly step rolling, insures longer tube life.

AIRETOOL has pioneered in the development of tube expansion tools for every type of tubular construction . . . will gladly recommend equipment for most economical tube maintenance in your plant. Write for details today.

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SPRINGFIELD, OHIO U.S.A.

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Electric Heaters

Chromalox offers you prompt service from the world's largest factory stock of industrial electric heaters . . . over 15,000 types, sizes and ratings. Local stocks at points throughout the nation.

There is a specific Chromalox Electric Heater to heat liquids, air and gases. For heating platens, dies, molds, moving metal parts . . . anywhere you need fast, clean, economical and easy-to-control heat up to 1100° F.

Let the Chromalox Sales-Engineering staff solve your heating problems . . . electrically

Write for your copy of Catalog 50

Contains information on complete line of Chromalox Electric Heaters, elements, thermostats, contactors and switches. Gives uses, construction information and prices, plus basic heat calculation data and heat loss charts.

For ideas on additional applications of electric heat, request Booklet F1550—"101 Ways to Apply Electric Heat." Write today.

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A-4447A

Circle 114 on READ-N-CIRCLE card

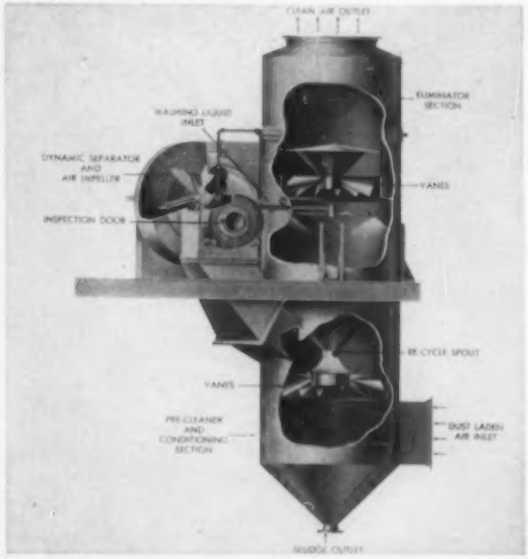
706-Oxygen analyzer is portable, rugged

Portable oxygen analyzer (Model D2) measures oxygen in almost any gaseous mixture. Accuracy of reading is not affected by other gases in mixture. Completely self-contained instrument is well suited for industrial

use in applications such as air measurements to improve combustion efficiency, monitoring air leakage in inert systems, and insuring safe entry into sewers. No special skill is needed for operation. Oxygen readings can be taken instantly in ranges from 0 to 25 percent. ARNOLD O. BECKMAN, INC.

707-Air washer has wide range

New centrifugal air washer is available for industrial dust control and recovery. Air washers, incorporating technical improvements, perform with equal success



over wide application ranges. Equipment solves collection problems of extremely fine dust, abrasive materials, heavy dust loads, and high-temperature applications. Unit achieves maximum operating performance with minimum maintenance expense and reasonable first cost. THE DUCON CO.

(more new products on page 36)

STOP

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22nd NATIONAL EXPOSITION of POWER & MECHANICAL ENGINEERING

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Management: INTERNATIONAL EXPOSITION COMPANY

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COCHRANE . . . FIRST IN WATER CONDITIONING

SILICA and SOLIDS

Reduction

VISIT OUR
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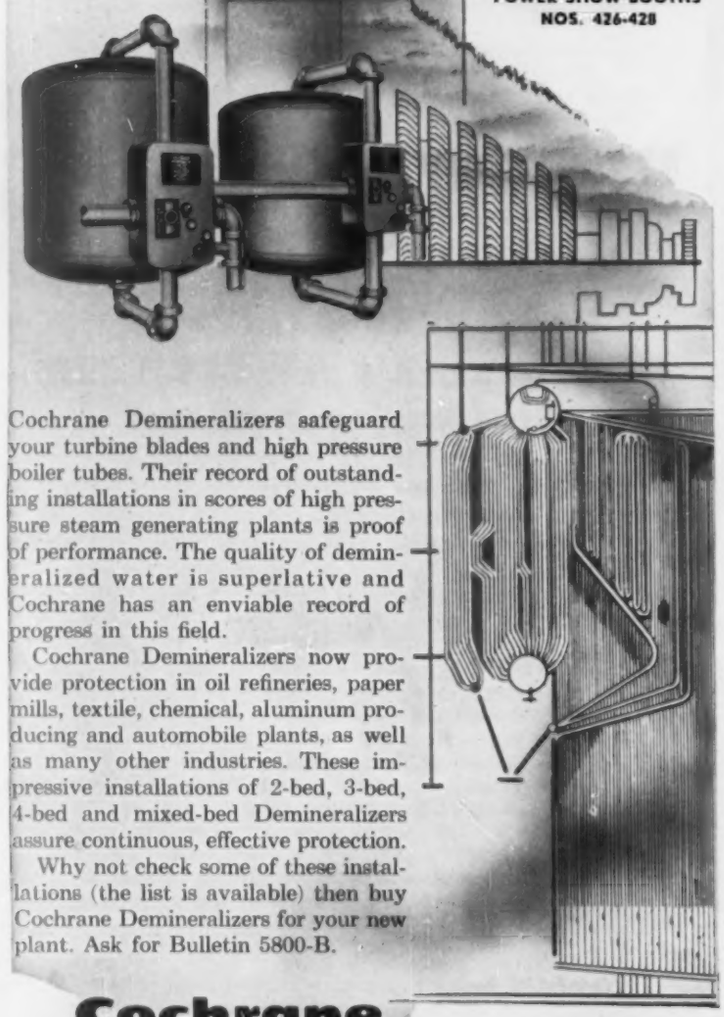

Cochrane Demineralizers safeguard your turbine blades and high pressure boiler tubes. Their record of outstanding installations in scores of high pressure steam generating plants is proof of performance. The quality of demineralized water is superlative and Cochrane has an enviable record of progress in this field.

Cochrane Demineralizers now provide protection in oil refineries, paper mills, textile, chemical, aluminum producing and automobile plants, as well as many other industries. These impressive installations of 2-bed, 3-bed, 4-bed and mixed-bed Demineralizers assure continuous, effective protection.

Why not check some of these installations (the list is available) then buy Cochrane Demineralizers for your new plant. Ask for Bulletin 5800-B.

Cochrane

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NEW YORK • PHILADELPHIA • CHICAGO

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Representatives in 30 principal cities in U.S.A.

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Dealkalizers • Reactors • Deaerators • Pressure Filters • Continuous Blowoff Systems
Condensate Return Systems • Steam Specialties

Circle 154 on READ-N-CIRCLE card for more data

new products

. . . starts on page 33

708-Prevent corrosion in stored pipe

Neoprene end caps effectively seal out air, moisture, corrosive fumes, dust, and small animals during pipe storage. By adding a small amount of dehydrating agent before installing end cap, internal corrosion is minimized or eliminated. Caps also retard drying of thread dope

and keep threads free of sand and grit. Caps are available for pipes from 2- to 20-inches diameter. Neoprene caps will withstand rough handling and repeated reuse. They are resistant to oil, acids, and other chemicals. Tough neoprene covers afford complete protection from supplier to installation. PROTOKAP, INC.

709-Portable pump is light, compact

Close-coupled, portable electric motor and pump unit develops dry suction lift of 15 feet. Bronze self-priming pump with neoprene impeller is directly connected to ¼-hp, 1725-rpm electric motor. Vacuum switch auto-

matically stops motor when liquid supply runs dry and eliminates danger of burned out impellers. Electric motor operates on any 115-ac, 60-cps, single phase source. Capacity is 10 gpm against 10-foot head. JABSCO PUMP COMPANY.

"It's Got Everything!"

SAYS
Smith E. Hughes
Past President
National Association
of Power Engineers,
Cincinnati Chapter

* * *

ABOUT THE NEW MODERN

SPEARHEAD
EXTENSION
GASKET CUTTER

"This is it! The tool that's modern in design . . . comfortable to the feel . . . simple to operate. It's the most accurate hand cutter I've used, and its smooth metal feel is great. I find the lightweight aluminum body makes cutting fast and easy. And it's just the right size for my tool kit. It's got everything."

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You'll agree . . . this new Spearhead model has everything you'd want for better, more efficient gasket cutting. This convenient hand tool cuts circular gaskets from 1" to 13" from any pliable sheet material — and with handy new extension arms, will cut precision round gaskets any size.

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•

Durable tempered steel blades — stronger, longer lasting — quickly adjusted in a second — with one easy twist of thumb screw. Direct inch and metric scales on cutter body—no more guesswork.

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Contact your local supplier for complete information and prices, or write to . . .

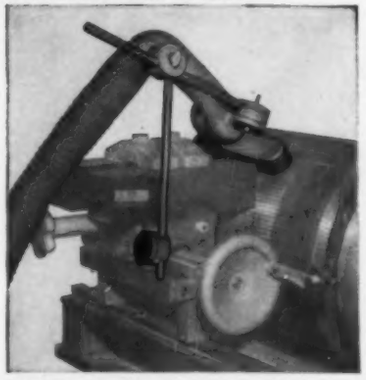
ZIMMERMAN PACKING

CINCINNATI 12, OHIO

Circle 138 on READ-N-CIRCLE card

an IDEAL idea...

DUSTLESS COMMUTATOR GRINDING!



Vacuum attachment picks up metal and stone dust as it is made . . . keeps it out of machine

- **Compact and simple, it does NOT interfere with work in progress.**
- **Fits all IDEAL industrial vacuum cleaner hoses; mounts on grinder or on motor or generator frame.**
- **Cuts clean-up time, prevents bearing trouble and hard-to-locate short circuits.**

Model No. 24-073 is for small commutators; mounts on Ideal's "Midget" Model Grinder or motor or generator frame. Stationary nozzle covers entire commutator.

Model No. 24-074 mounts on Ideal's "Perfect" or "Ideal" Model Grinder, traverses large commutators with the grinder.

Write for more information on these handy attachments. When writing, also ask for IDEAL's informative series of articles on "Commutator and Slip Ring Maintenance."

IDEAL INDUSTRIES, INC. (IDEAL)
1023 Park Avenue, Sycamore, Illinois
☐ Send more data on vacuum attachment described in this ad.
☐ Add my name to your mailing list for FREE "Commutator & Slip Ring Maintenance" articles.
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Address_____
City_____ Zone____ State_____

Circle 131 on READ-N-CIRCLE card

710-Automatic temperature monitoring

Automatic monitoring and accurate temperature control is now available from −200 to +3000 F. "Tipp-Tron" prevents equipment and processing temperatures from rising or falling past preset point. Double-limit units are available to maintain temperatures within specific and

easily adjustable ranges. Unit is supplied in 10 temperature ranges. With thermocouples as sensing elements, they are used in ovens, kilns, fire alarm systems, bearings, and conveyors. "Tipp-Tron" can be furnished with solenoid valves to operate main fuel supply valve. Available with either single or multiple-meter models to provide control for any number of individual temperature control points. TIPP MANUFACTURING COMPANY.

MORE INFORMATION

For more detailed free information on these products just circle the key numbers on a READ-N-CIRCLE card on page 47 or 48.

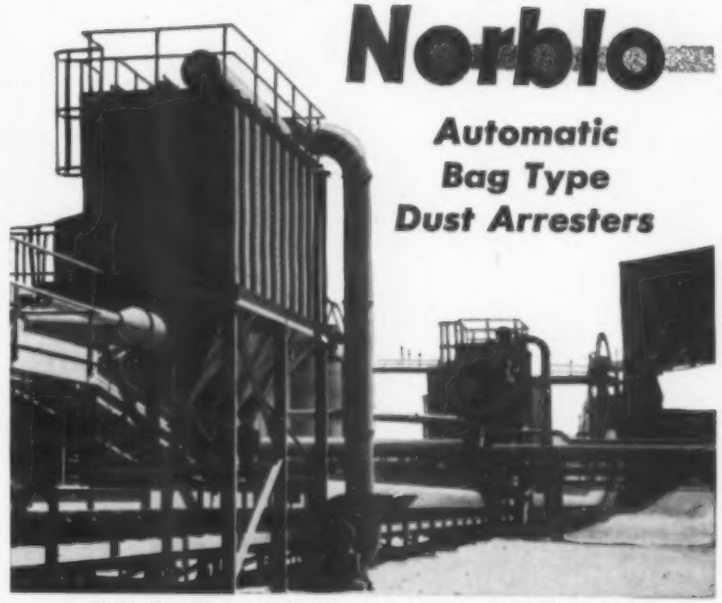
711-Automatic condensate return pumps

Single and duplex condensation return pumping units can be operated without foundations. New units are rated up to 10,000 square feet of direct radiation with pressures up to 20 psi. High-pressure units are available up to 50 psi. Compacitor motor has built-in

thermatron and overload protection with automatic reset. Duplex units are equipped with alternator float switch to operate pumps in sequence or together under peak loads. Automatic controls have double-pole float operated switch on receiver. THE DEMING COMPANY.

(more new products on page 38)

Full dust collecting capacity always available from Norblo

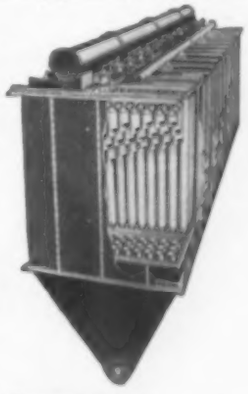


Norblo Dust Arresters at California Cement Corp. plant at Mojave, Cal.

Twenty-four hours a day is a gruelling grind, but Norblo equipment takes it. What's important to plant owners and operating staff is that full dust collecting efficiency holds level during the day and night punishment.

Norblo installations include a group of basic compartment units, each housing 78 cylindrical bags. Variable cyclic cleaning involves one compartment at a time, and that for only a few seconds. Engineered to the needs of each installation, there's ample capacity without waste, but without undue strain on the equipment. Easy maintenance is provided for.

Users of Norblo Equipment in cement plants, industrial plants of many types, and mining and smelting agree that complete satisfaction is assured when you install Norblo. Write for information—state your dust collection problem.



Norblo also builds centrifugal and hydraulic dust collectors, exhaust fans, cement air cooling systems, and portable type dust collectors.

The Northern Blower Company
6422 Barberton Ave., Cleveland 2, Ohio • OLympic 1-1300

Norblo ENGINEERED DUST COLLECTION SYSTEMS FOR ALL INDUSTRIES

Circle 101 on READ-N-CIRCLE card for more data

Power Plant Keeps Coal Handling

DUST FREE

from Railcar to Bunkers

BEFORE **AFTER**

This power plant in Danville, Virginia uses a **Johnson-March engineered liquid dust-control system** to eliminate troublesome coal dust in all stages of their coal handling. From railroad gondolas, where the coal is dumped on a conveyor, to the pulverizer, this plant has done away with the hazard of dust explosion, abrasion and wear and tear on their power plant equipment. Working conditions are greatly improved and maintenance time has been reduced to a minimum.

The before and after photos above are an example of the efficient manner in which the J-M system controls the coal dust in this plant. Even the efficiency of existing mechanical dust collectors can be improved by the addition of a Johnson-March liquid system.

Write today for a free analysis of your dust problem . . . no obligation of course.

Johnson March

Dust Control Engineers

1724 CHESTNUT ST., PHILADELPHIA 3, PA.

CANADIAN REPRESENTATIVES: O. F. Sterne and Sons, Ltd., Brantford, Ontario

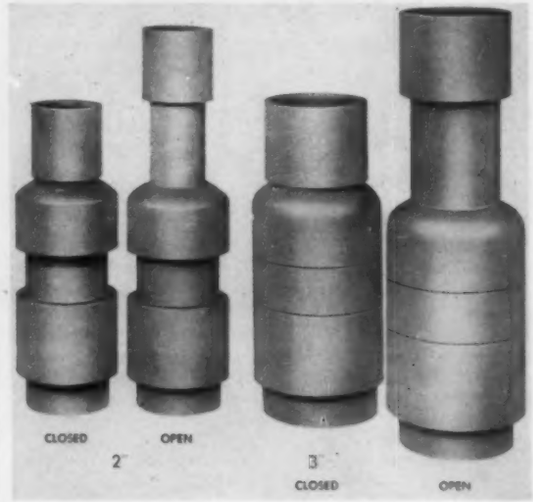
Circle 100 on READ-N-CIRCLE card for more data

new products

. . . starts on page 33

712-Expansion joints in PVC

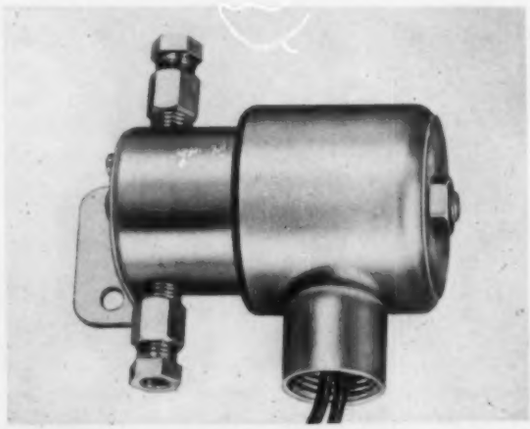
First slip-type pipe expansion joint made with unplasticized PVC is now available. Expansion joint is designed for use with rigidly fixed PVC piping subjected



to thermal cycles. It has Neoprene "O" ring packing and is suitable for a wide range of corrosive services. All sizes allow an expansion of 3¾ inches. Joint has been tested at pressures up to 325 psi and temperatures up to 140 F. Tube Turns Plastics, Inc.

713-Air valves operate silently

Electrically operated air valves function without annoying ac hum or chatter. Valve is recommended for noiseless control of air conditioning damper motors, as well as for control of pneumatic motors and valves on

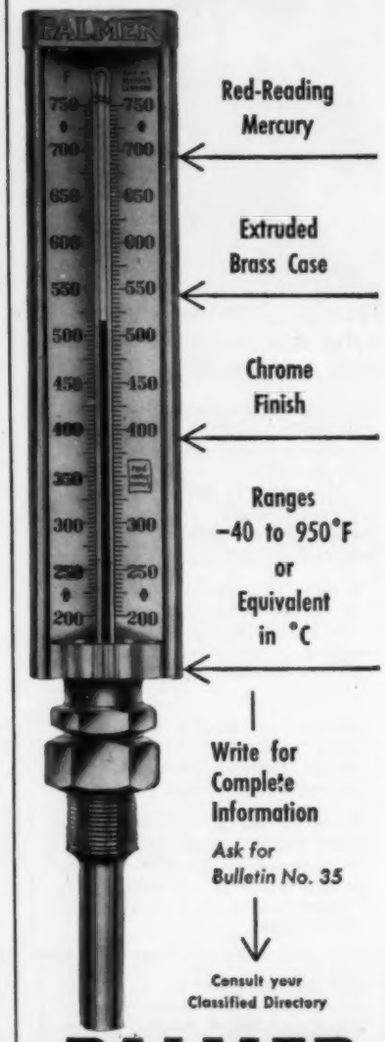


industrial equipment. Sixty-cps coil can be supplied for voltages of 115, 208, 230, or 440. Inlet and outlet connections are ⅛-inch NPT. Valve is Underwriters' Laboratories approved. The Powers Regulator Company.

Today's Modern Industry
Demands a Modern Thermometer

PALMER

RED-READING MERCURY THERMOMETERS



Write for Complete Information

Ask for Bulletin No. 35

Consult your Classified Directory

PALMER

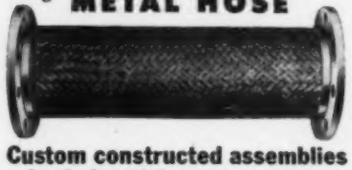
THERMOMETERS, INC.

Mfrs. of Industrial Laboratory, Recording and Dial Thermometers

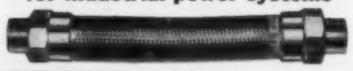
Cincinnati 12, O.

Circle 119 on READ-N-CIRCLE card

COBRA®
FLEXIBLE
SEAMLESS
METAL HOSE



Custom constructed assemblies for industrial power systems



All sizes in bronze, stainless or carbon steel, monel, inconel and low carbon nickel. Seamless spiral or parallel corrugation... Braided. All type of fittings and flanges welded, brazed or soldered. Also, interlocked hose.

write — wire — phone: RE 7-3311
...for prices and catalogs

COBRA METAL HOSE
4640 W. 54th Street • Chicago 32, Ill.

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ERNST
STAINLESS STEEL
GAGE OR IRON

(with ½" or ¾" connections)

SHIPMENTS FROM STOCK

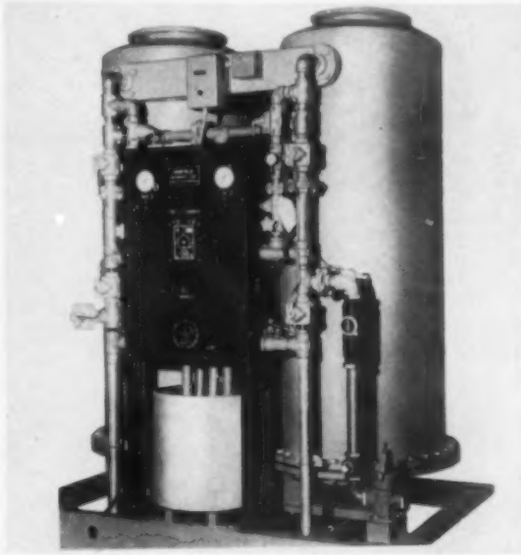
FIG. 8SS STAINLESS

FIG. 8 IRON

Send for Catalog
Phone Livingston 6-1400
ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J.
Circle 120 on READ-N-CIRCLE card

714-Here's automatic demineralizer

Industrial demineralizer (Model ULA-2500) operates on dual-column ion exchange principle (one column each of cation and anion resins.) Unit features fully automatic regeneration system including rinsing and recutting in the effluent when desired pre-set standard



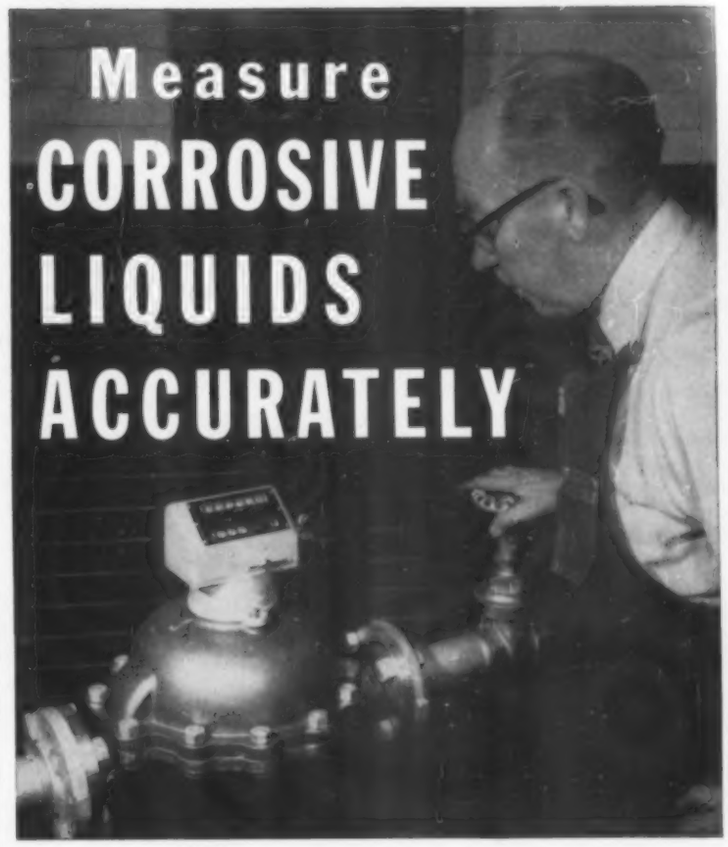
of resistance is reached. Unit capacity is 2500 gph with purity of less than 2 ppm. All operating functions are automatic. When effluent's purity falls below desired standard, unit automatically stops delivering treated water and signals need for regeneration cycle. Regeneration cycle is initiated by closing one switch and completes itself entirely automatically. PENFIELD MANUFACTURING CO.

MORE INFORMATION

For more detailed free information on these products just circle the key numbers on a READ-N-CIRCLE card on page 47 or 48.

715-Aluminum paint good to 1700 F

High-heat aluminum paint is capable of withstanding temperatures up to 1700 F without blistering or burning. Paint is composed of a clear silicone base with special aluminum flake pigment. This combination air dries to a bright finish in approximately 30 minutes. When heated, it virtually fuses with the surface upon which it is applied. Paint forms a metal coating that resists moisture, corrosion, mild acids, alkalis and industrial fumes. Recommended for condensers, heat lines, ovens, compressors, engine heads, mufflers, radiators, stoves, and exhaust manifolds. Paint can be applied by brush or spray gun. CHEM INDUSTRIAL CO. ♦♦



with NIAGARA
Displacement Meters

Now you can apply the extreme accuracy of Niagara Meters to the measurement of corrosive liquids. Niagara Chemical Meters of Type 316 stainless steel offer good resistance to corrosion and can be used to measure caustic soda, most acids, fruit juices and similar liquids. Available in sizes 3 to 110 G.P.M. or in intermittent use up to 160 G.P.M. Niagara Chemical Meters are also available for automatic liquid measurement and liquid flow control in hazardous or non-hazardous atmospheres.

If you have corrosive liquid metering problems, let us help you. Mail coupon today.

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BUFFALO 14, NEW YORK

Please send me information on the complete line of Niagara Meters.

Liquid .....
Flow g.p.m. ..... Temp. ..... °F
Name .....
Company .....
Address .....

Circle 147 on READ-N-CIRCLE card for more data

new bulletins

. . . just circle key numbers on READ-N-CIRCLE card on pages 47 or 48

400-Guide to tubing selection

Charts and tables in Bulletin 4305 help you select tubing of correct size, wall thickness, and material for various operating conditions. Factors of flow, pressure, service conditions, and temperature are considered. Eight pages. Tube & Hose Fittings Div., The Parker Appliance Co.

401-Service guide to piping hookups

Pocketsize Bulletin M-71 gives data on correct piping hookups, methods of troubleshooting, parts replacements. Drawings illustrate common installation errors. Sixteen pages. McDonnell & Miller, Inc.

402-Banishing noise, vibration pays off

Case histories cited in Bulletin K7A tell how eliminating vibration and noise steps up plant efficiency. Installation photos show methods of mounting machine tools on isolation units. Eight pages. The Korfund Co. Inc.

403-To measure specific gravity, density

Bulletin G-3 describes hydrometers and thermo hydrometers for accurate indications of specific gravity or other density. Individually calibrated handmade scales show percentage of alcohol, API, Baume', percentage of calcium chloride, and specific gravity. National Bureau of Standards approved. Eight pages. Precision Thermometer & Instrument Co.

404-Selector guide for panel control systems

Package control systems for automatic oil, gas, and combination oil-gas burners are described in Bulletin CA-22. Concise selector guide aids in selecting the right panel control system. Sixteen pages. Electronics Corporation of America.

405-Handbook on tubing supports

Bulletin 656-G describes all components of P-W tubing and piping support system. Adjustable connectors and trough or ladder supports eliminate cutting and waste in the field. Twenty pages. P-W Industries, Inc.

406-Conveyor equipment built to order

Catalog 500 describes custom-built conveyor equipment, such as bucket elevators, screw and belt conveyors, vibrators and vibrating conveyors, pneumatic conveyors, and flux and chip handling systems. Also describes totally enclosed bulk material handling conveyor featuring two-directional chain to convey in any direction. Forty-eight pages. Prab Conveyors, Inc.

411-Manual on tool steels

Fourth edition of "Tool Steel Handbook" contains latest data on tool steels including types, properties, uses, and problems of working tools and high-speed steels. Includes handy reference tables. 204 pages. Allegheny Ludlum Steel Corp.

412-Selenium rectifier handbook

Bulletin GEA-6545 gives features, uses, charts, construction details, dimensions, and specifications for selenium rectifiers. Data covers rectifiers from ¾ kw to 125 kw, plus multiples to 500 kw. Twelve pages. General Electric Co.

413-Save trapped accident victims

Porto-Power rescue equipment kit includes hand-operated pump and ram, with attachments for lifting, pushing, pulling, spreading, clamping, and pressing. Flexible hose joining permits remote control. Manual HR-300 includes photos of actual rescue operations in which the rescue kit is used. Twelve pages. Blackhawk Mfg. Co.

414-Cooling tower data

Bulletin 203 gives complete engineering data on cooling towers designed for use when water temperatures are critical. Units have capacity safety factor to insure positive performance under any condition. Eight pages. The Baltimore Aircoil Co.

415-Diaphragm pump data

Multi-speed positive displacement pumps permit volume adjustment while pump is running. Output volume is controlled by changing operating speed. Bulletin describes Madden pump sizes, capacities, and speeds. Diagrams illustrate pump features. Sixteen pages. The Madden Corp.

416-Engineering specs on pipe hangers

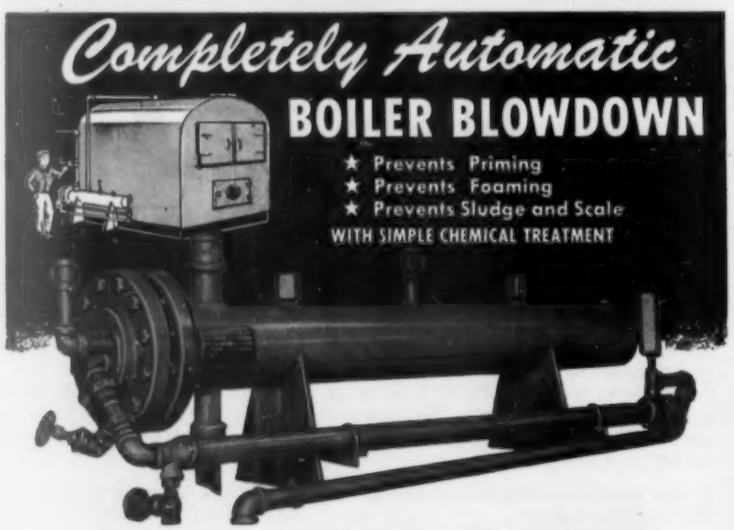
Weight-load selection tables, erection and adjustment information, mechanical specifications, and engineering drawings are included in Bulletin 156. Counterpoise hangers provide constant support for piping systems subject to vertical or horizontal movement from expansion or contraction with temperature change. Sixteen pages. National Valve and Manufacturing Co.

417-If speed is your problem

Booklet B-6727 gives speed reducer details including horsepower ratings, torque capacity, and overhung load values. Lists dimensions plus installation and maintenance information for single, double, and triple reduction. Reducers may be driven by electric motors, gas, oil, or diesel engines. Forty-four pages. Westinghouse Electric Corp.

418-Butterfly valve data

Technical data in Bulletin B-2 are directed to all engineers responsible for handling and controlling large volumes of liquids or gases. Manual describes characteristics of rubber-seat butterfly valves, gives space re-



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But more important than the winners, the Power Show Contest gives insight never before available from such a vast group — power services engineers of all ages, from many and varied industries, from large and small firms, and from all over the country. What did the Power Show Contest reveal?

See page 11.

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quirements, and aids for valve selection. Includes conversion tables, and pressure drop and flow tables. Forty pages. THE HENRY PRATT CO.

419-Water treatment equipment manual

Precipitation and adsorption method of feedwater treatment used in Accelerator and Hot-Flow softeners is described in Bulletin NICSI-A. Covers chemistry of hot process treatment. Compares results of various treatments. Lists equipment and accessories available. Twenty pages. INFILCO INC.

420-Fintube heat exchangers specifications

Data in Bulletin FH-3 includes installation dimensions, finside coefficient charts, and finside pressure-drop charts for all sizes of fintube heat exchangers. Alcotwin longitudinal fintubes feature U-shaped fin channels integrally bonded to tubes by Heliarc welding. Eight pages. ALCO PRODUCTS, INC.

421-Dc motor guide to 200 hp

Shunt, stabilized shunt wound, compound wound, and series wound motors in eight enclosures are described in Bulletin 53B8424. Cutaway view and line drawings show construction details. Motor-generator sets for conversion from ac to dc also available. Six pages. ALLIS-CHALMERS MANUFACTURING CO.

422-How to specify steel tubing, pipe

Folder TDC-186 is a handy guide to help you determine proper uses of carbon, alloy, and stainless steel tubing, pipe, seamless welding fittings and flanges. ASTM and AAR specifications included. Four pages. TUBULAR PRODUCTS DIV., THE BABCOCK & WILCOX CO.

407-Miniature bayonet thermocouple handbook

Miniature bayonet thermocouples can be used for engine and pump-cylinder heads, turbine housings, electric motors, generators, and transformers. Bulletin tells how to select proper thermocouples and adapters. Has guide to determine adapter length and thermocouple immersion length for a given hole depth. Ten pages. THERMO ELECTRIC CO., INC.

408-Tube expanders, cutters data guide

Catalog 81 contains specifications and operating data on Ideal line of tube cutters, expanders, and accessories. Illustrated catalog is fully indexed for handy reference. Thirty-two pages. THE GUSTAV WIEDEKE CO.

409-Generator sets to fill every need

Illustrated Bulletin 6SA20 describes 25 radiator- and heat-exchanger-cooled generator sets from 20 to 245 kw. Available either in 50- and 60-cps units or in dc units. Designed for emergency standby and continuous off-the-line uses. Twenty-four pages. DETROIT DIESEL ENGINE DIV., GENERAL MOTORS CORP.

410-Guide to wall-to-wall lighting systems

Advantages of three-way treatment of illumination, noise control, and styling with wall-to-wall "Sylvan-Aire" lighting systems are illustrated in Booklet V-500. Suspension system permits quick installation. Describes easy adjustment to special requirements for any building or plant. Comes as complete package. Twenty pages. SYLVANIA ELECTRIC PRODUCTS INC. ♦ ♦

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basic bulletins

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AIR CLEANING EQUIPMENT

500-Dust collector manual

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrester types are the subject of a 32-page bulletin. Gives uses of air-conditioning, ventilating, conveying, drying, cooling units. KIRK & BLUM MFG. CO.

AIR CONDITIONING, HEATING, VENTILATING

501-Air-conditioning history

Development of air-conditioning units from earliest attempts to present-day techniques are discussed in Booklet "Why RK?". Booklet compares three air-conditioning installations as to savings in initial and maintenance costs, on-the-site labor, materials, space, and year-round use. Thirty-six pages. UNITED STATES AIR CONDITIONING CORPORATION.

BOILERS AND BOILER ACCESSORIES

502-How to survey your steam needs

Formulas behind all package steam generators and illustrations of how a package steam generator installation can raise steam capacity without extensive structural changes are presented in Booklet "Sales Steam-2-1." An example shows how to make a professional survey of your own steam requirements. Complete records and two installation case histories are included. Twelve pages. CYCLOTHERM DIVISION, NATIONAL-U.S. RADIATOR CORPORATION.

503-Boiler maintenance tool manual

Boiler tubes need cleaning, replacement? Bulletin 59 describes the entire line of precision-made boiler tube maintenance tools. Includes complete data on tube cleaners, cutters, and expanders. Lists sizes, weights, and operating speed of each unit. Includes description of complete line of accessories to make your boiler maintenance chores easy. Describes boiler tube cleaners for tube sizes from ½-inch to 4-inch id. Eight pages. AIRETOOL MANUFACTURING COMPANY.

504-Blowdown control chart

Determination of the rate of boiler blowdown and selection of a correctly sized heat exchanger are made possible with use of simplified Chart JPC, based on total dissolved solids in boiler water. Also given are recommendations for selection of blowdown equipment in accordance with normal operating conditions of boiler installation. HENSZEY CO.

BUILDING CONSTRUCTION, MATERIALS

505-Aluminum handbook

"Alcoa Aluminum Handbook" describes complete line of aluminum forms, alloys, and physical properties. Ten sections cover aluminum fabrication into sheet, plate, wire, rod, tubular goods, electric conductor, structural shapes, and forgings. Includes tabular data on physical and chemical properties of all well-known alloys. 176 pages. ALUMINUM COMPANY OF AMERICA.

COMPRESSED AIR SUPPLY

506-Diagnose your compressor troubles

Helpful aids to locate and correct common air-cooled and water-cooled compressor troubles are contained in Bulletin PC-509P. Cartoon sequence gives full description of compressor troubles and solutions. WORTHINGTON CORPORATION.

ELECTRIC DISTRIBUTION

507-Interlocked armored cable data

Bulletin 19-555 contains complete data on interlocked armor cable designed specifically for primary and secondary feeders in industrial power distribution systems, generator leads, station auxiliaries, and station control cables. Lists cable with five different insulation materials. Eighteen pages. GENERAL ELECTRIC COMPANY.

508-Lowdown on dry transformers

The applications, sizes, types, and construction of air-cooled dry-type transformers is described in Bulletin 155. Specifications are included. Special custom-built transformers and reactors are discussed. Eight pages. SORGEL ELECTRIC COMPANY.

509-Electric conductor data

Engineering data on laboratory tests and service records covering performance of electrical conductors are contained in engineering Bulletin EB-27. Operating temperatures, dielectric strength, aging, insulation resistance, moisture absorption, and power factor are discussed in detail. ANACONDA WIRE & CABLE CO.

ELECTRIC UTILIZATION

510-Here are 101 ways to heat with electricity

Industrial electric heating applications and methods are described in 32-page Booklet, "101 Ways to Apply Electric Heat." Illustrated case histories show experience-tested ways to apply metal-sheathed Chromalox electric heating units. EDWIN L. WIEGAND CO.

FUELS AND FIRING EQUIPMENT

511-All about fuel oil additives

How to get complete protection from fuel tanks to burner tips is described in Bulletin 5012-A. Additives

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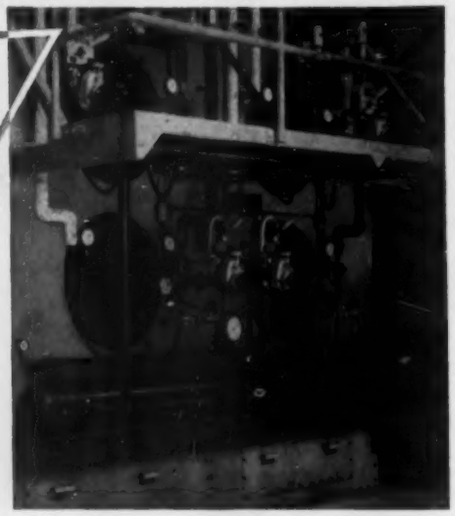

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BASIC BULLETINS SUBJECT INDEX

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Water supply and treatment 45

eliminate desludging operations, keep screens and burners clean, improve atomization and combustion, eliminate smoke and soot, and reduce rusting, pitting, and leaks. Includes recommended amounts of additive per 1000 gallons of fuel oil. Four pages. DEARBORN CHEMICAL COMPANY.

512-Refuse and wood burning

Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page Booklet 505. Stationary, manual dumping, power dumping, and traveling grate installations having maximum capacities from 10,000 to 275,000 lb/hr are described. DETROIT STOKER CO.

513-New combustion sampling

Full story of a newly developed sampling system for continuous troublefree sampling and oxygen measurement of combustion processes is told in Bulletin 703. Equipment described is designed for steam generating plants, rotary kilns and driers, open hearth furnaces, and tanks. ARNOLD O. BECKMAN CO., INC.

INSTRUMENTS AND CONTROLS

514-How to measure water vapor

Measurement of water vapor in air and other gases is informatively discussed in Bulletin 224. Discusses gravimetric, dewpoint, and wet- and dry-bulb methods, as well as some less common and even experimental methods. An easy-to-understand discussion of moisture measurement, causes, and effects. Twelve pages. PITTSBURGH LECTRODRYER CORPORATION.

515-How to select liquid-level control

Bulletin-1 discusses the factors to be considered in selecting a liquid-level control. It includes controls in types and sizes for handling practically any liquid, at any pressure and temperature. A handy guide to selecting liquid-level controls. Eight pages. MAGNETROL, INC.

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516-All-purpose water flow meters

Principles of operation of nutating-piston-type meters are explained in Bulletin 36. It contains illustrations and data of typical installations, trap strainers, air release valves, high-pressure meters, and meter registers for the measurement of most fluids. Twenty pages. BUFFALO METER CO.

LUBRICATION

517-Do's and don'ts for bearings

A helpful list of "do's" and "don'ts" to prolong bearing life appears in Bulletin 506. Also included is information on the storage and handling of industrial lubricants. Four pages. NEW YORK AND NEW JERSEY LUBRICANT CO.

MAINTENANCE ITEMS

518-Modern tube expanders

The latest tube-expanding equipment available for fire-tube boilers, water-tube boilers, condensers, and similar heat transfer units is explained in new bulletin. Typical boiler and condenser units are illustrated. Four pages. THE GUSTAV WIEDEKE COMPANY.

519-Complete tube expander manual

Detailed information on tube expanders, tube rollers, and associated tools is contained in Catalog 88. Lists many new tools and gives description of how each is used. Illustrations show tools used in maintenance of boilers, condensers, and evaporators. 119 pages. THOMAS C. WILSON, INC.

520-Repair methods handbook

Text and illustration in this 48-page handbook present repair methods for leaks in pipes, boilers, radiators, concrete, cinderblocks, and sheet and plate metal. Directory describes 12 typical repair cements and jobs they will do. SMOOTH-ON MFG. CO.

521-Hose selector slide rule

Here's your chance to get a pocketsize slide rule for easy selection of rubber-covered Wiretex hose. Selector contains latest SAE and industry specifications on hydraulic hose. Covers hose diameters from 3/16- to 2-inch id and includes data on working pressures up to 5000 psig. REPUBLIC RUBBER DIVISION, LEE RUBBER & TIRE CORPORATION.

522-Packing and gasket buyers' guide

Catalog P-200C describes packing rings, piston cups, gaskets, braided and plastic packings, and asbestos sheet packing. Includes specifications on all packing types with corresponding manufacturer's number. Forty pages. RAYBESTOS-MANHATTAN, INC.

523-Handbook on specialty steels

Distinctive characteristics of a broad range of special purpose steels in terms of end use are given in this comprehensive handbook. It briefly summarizes tool and die steels, stainless steels, silicon and high-nickel electrical

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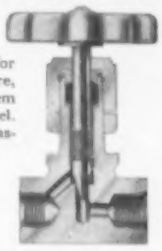

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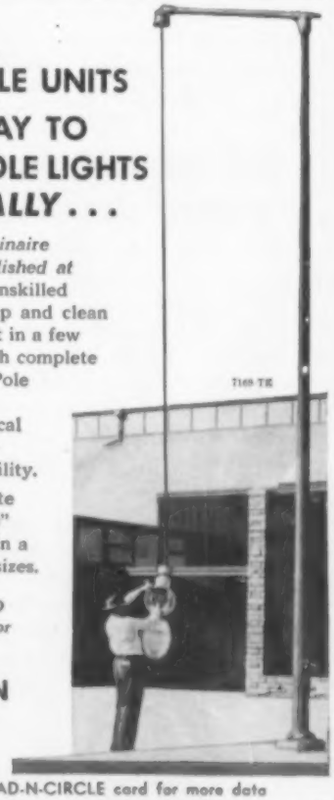

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December Issue

INDUSTRY POWER

basic bulletins

. . . starts on page 42

alloys, special purpose alloy steels, valve, heat-resisting and super-alloy steels, tubing and pipe, and fine wire. Will help to match the proper steel to the job. Thirty-two pages. THE CARPENTER STEEL COMPANY.

MECHANICAL POWER TRANSMISSION

524-Power transmission data

Bulletin 2653 contains illustrations showing how Link-Belt power transmission equipment serves every industry. Illustrations show conveyors, chain drives, bearings, gears, and complete line of accessories. Lists additional technical literature for information on specific subjects. Forty-four pages. LINK-BELT COMPANY.

525-Power transmission encyclopedia

Here is a valuable reference book for all engineers interested in mechanical power transmission machinery. Completely covers base plates, bearings, chains, clutches, collars, couplings, keyseats, pulleys, shaftings, speed reducers, sprockets, takeups, and bushings. A special section is devoted to belts, drive tables, sheaves, and variable speed tables. Worth keeping on your book shelf. 328 pages. DODGE MANUFACTURING COMPANY.

PIPING, TUBING, AND HOSE

526-Expansion joints from A to Z

Engineering data on full line of expansion joints from 3 to 72 inches in diameter are contained in Catalog 56. Gives selection chart showing how to choose correct joint for given conditions. Includes full dimensional and temperature data on all models in the line, both flanged and welding end. Seventy-two pages. ZALLEA BROTHERS.

527-Color code identifies pipe for safety

Reference chart outlines accepted use of color in safety practices for protecting property and personnel. May be posted in shop for quick, easy reference. Includes recommendations for pipeline identification by uniform safety color code. Lists five main classes and colors to identify each class: safe, dangerous, protective, valuable, and fire protective. Describes use of basic colors supplemented by symbols to make equipment identification easily remembered. THE ARCO COMPANY.

528-How to install pressure pipe

Manufacturer's recommendations for installing "Transite" pressure pipe to meet all conditions are contained in Bulletin TR-180A. Describes and illustrates details including loading and unloading, machining and cutting, flange installation, and supporting. Includes dimensional data and pipe weights in sizes from 4 through 16 inches. Also includes complete list of fittings and connections. Forty-eight pages. JOHNS-MANVILLE.

529-Insulated piping practices

Insulated pipe units for handling all power, utility, and process media are described in Bulletin 56-1. Describes connections, trench widths, recommended insulation, and pipe clearances. Gives factory prefabricating methods that minimize installation time and cost. Twenty-four pages. RIC-WIL INCORPORATED.

PUMPING EQUIPMENT

530-Centrifugal pumps that won't clog

Bulletin 121A describes non-clog pumps for handling solids in suspension. Includes vertical, horizontal, and close-coupled types. Recommended for handling industrial process liquids and wastes, water supplies, and drainage. Capacity chart lists pumps with capacities from 50 to 7000 gpm. Eight pages. AURORA PUMP DIVISION, NEW YORK AIR BRAKE COMPANY.

531-Automatic sump pump data

Complete engineering data on a line of sump pumps that covers every application are presented in Bulletin 5530. Submersible sump pumps, vertical pumps, and hydraulic operated drainers are discussed. Four pages. PENBERTHY INJECTOR COMPANY.

532-Handbook of hydraulic tables

This comprehensive reference work is now available for engineers interested in pumping and piping problems. Bulletin 50 also contains data useful to all engineers. Twenty-eight pages. THE ALDRICH PUMP COMPANY.

REFRACTORIES AND INSULATION

533-Refractory construction

The different types of construction considered standard for industrial refractory are described in Bulletin 39. Bulletin is well illustrated. Twenty pages. BIGELOW-LIPTAK CORP.

541-Facts about industrial insulation

New additions to the line now give full coverage in industrial insulation products, as covered in Bulletin A-400. Describes new, accurately molded product made from inorganic silicas that will withstand temperatures up to 1600 F. Insulation shows no deterioration or effect on thermal conductivity after exposure to high moisture. It is furnished as pipe covering in convenient three-foot sections, flat, curved, or segmental blocks. High thermal efficiency and high structural strength enable it to be used in single-layer applications or as a base layer with 85-percent magnesia. Four pages. THE EAGLE-PICHER COMPANY.

TRAPS, STRAINERS, AND SEPARATORS

534-Quick-coupling fluid filters

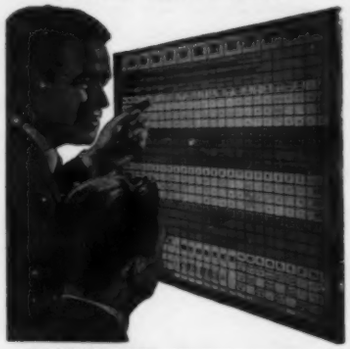
Construction and operation information on non-short-circuiting fluid filters and strainers is presented in Bulletin 45570. Mesh sizes are tabulated with sizes and ratings of multiplex units. Four illustrated pages. RONNINGEN-PETTER COMPANY.

VALVES AND REGULATORS

535-Lowdown on blowdown

New concept uses quick-change orifices to control boiler blowoff, as discussed in Bulletin 152. Text describes installation and operating procedure for this

How To Get Things Done Better And Faster



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unique, easily controlled system. Illustrations show typical installation and show how quick-change orifices can be replaced in a minimum of time. Four pages. THE UNI-BLOW VALVE COMPANY.

536-Data for full line of valves

Complete lines of valves for industrial use that meet a wide range of pressure, temperature and corrosion conditions are offered in Catalog No. 654. Specifications and engineering data are included. Sixty-six pages. REPUBLIC MANUFACTURING CO.

537-Control valve reference book

Three basic types of single-seated diaphragm control valves are discussed in 15-page Bulletin 5304. Cutaway views and charts with complete specification data make this a good reference book. LESLIE CO.

538-Why not a solenoid valve?

If you use direct operated solenoid valves for automatic or remote flow control of liquids and steam up to 400 F, or of high viscosity liquids you will want to read Bulletin V-2. Normally closed, normally open, explosion-proof normally closed, and three way valves are shown. Eleven pages. THE JOHNSON CORP.

HOW TO GET COPIES

To get a free copy of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on pages 47 or 48.

540-General-purpose valve manual

Gate, globe, and angle valves in sizes from ¼ through 2 inches are described in Bulletin F-9, supplement 1. Also includes pressure-temperature rating chart for carbon and alloy steel valves. Dimensional-sectional views of 11 available valve configurations are given. An excellent manual for the engineer faced with a valve or piping problem. Thirty-two illustrated pages. HENRY VOGT MACHINE CO.

WATER SUPPLY AND TREATMENT

539-Clean boilers give better operation

Complete water treating service from initial survey to operating report forms is discussed in this bulletin. Describes treatment that stops scale, corrosion, foaming, and carryover by using correct treating compounds. Describes portable water test kit for field use. Gives quick, accurate test of water samples without knowledge of chemistry or involved calculations. Four pages. NORTH AMERICAN MOGUL PRODUCTS COMPANY.

543-Simplify water treatment

Information to accurately select water treating equipment for any plant, industry, or other institution is contained in this bulletin. Three basic exchange materials are discribed. Includes water and brine distribution mechanism and exchange material depth. Sketches show direction of water and brine flow during service, brine-rise, and regeneration cycle. Contains specifications including flow rates, exchange capacities, amount of salt, and shipping weight. Eight pages. ILLINOIS WATER TREATMENT COMPANY. ♦ ♦

pd offers 5 basic boiler components

P-D makes it easier, safer and quicker when you sign that order for steam generating auxiliary equipment. There's no time delay; no engineering problems; no piece-by-piece delivery from different sources.

Prat-Daniel's *single responsibility* guarantees equipment of balanced design . . . matched for ease of assembly, unmatched for peak performance. Each component is built to complement the other, with the integrated unit providing highest efficiency for your system.

Prat-Daniel offers years of specialized experience in the design and development of *Forced Draft Fans, Air Preheaters, Tubular Dust Collectors, Induced Draft Fans* and *Fan Stacks* for industry.

Contact The Thermix Corporation, Project Engineers for Prat-Daniel, for your requirements. Ask for data sheets on P-D equipment.

Project Engineers
THE THERMIX CORPORATION
GREENWICH, CONN.
(Offices in 38 Principal Cities)
Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Que.

Designers and Manufacturers
PRAT-DANIEL CORPORATION
SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks
Circle 106 on READ-N-CIRCLE card for more data

How MOGUL solved water treatment problems for SIBLEY FARMS

JERSEY MILK SERVICE INCORPORATED

The North American Mogul Products Co.
Cleveland, Ohio

Gentlemen:

About a year ago, you set up for us a program for treating the water we use generally throughout our plant. This program involved our city water supply, our boiler water supply, and our sweet water supply, using Mogul products designed for these problems.

At the time, our city water supply, being acid in nature, was causing a serious rusting condition in our bottle washer and other tanks and pipes. MOGUL RUST ERADICATOR has stopped further corrosion and cleaned up the rust accumulation which existed. It has definitely been successful in correcting the condition for which it is designed.

Our sweet water supply likewise was very rusty; now, after using MOGUL M-12, the water has cleared up and rusting within the tanks has ceased.

Using MOGUL M-16 in our boiler water initially removed what appeared to be a scale buildup in the coils of our steam generators and has prevented any further buildup.

Your program of feeding and testing the water for these uses has been quite successful and gratifying. It unquestionably saved the tank in our bottle washer and has cut down the need for replacing the piping in the plant.

Many thanks for your time and effort.

Very truly yours,

Walter Irvine
Plant Superintendent

Plate Cooler

Bottle Washer

Steam Generators

An actual case history of accomplishment with MOGUL. You too, can remove scale, rust and corrosion, effectively and economically.

Write us today about your water problems.

MOGUL

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Ever Clean Boiler Process
Algicide • Amine

The North American

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Products Company

STANDARD BUILDING • CLEVELAND 13, OHIO

40 YEARS OF PROGRESS . . . AND STILL GROWING

Circle 152 on READ-N-CIRCLE card for more data

names make news

. . . personalities from industry power

Bituminous Coal Research, Inc. appoints **Robert D. Saltsman** to its Columbus, Ohio laboratory as project engineer. **Robert W. Stephan** joins the BCR Pittsburgh laboratory as chemical engineer.

AIEE announces chairmen of newly reorganized departments for coming year: **J. C. Strasbourger,** Cleveland Electric Illuminating Co., Administration; **J. L. Callahan,** RCA Laboratories, Admission and Advancement; **W. Scott Hill,** General Electric Co., Publications; **W. A. Lewis,** Illinois Institute of Technology, Professional Development and Recognition; **W. R. Clark,** Leeds & Northrup Co., Technical Operations.

Mazza

Stratton

Bart-Messing Corp. promotes **John R. Mazza** to manager of manufacturing. Formerly chief engineer, he is well known for work on rectifier design.

Dravo Corp. appoints **William C. Stratton** chief engineer, Engineering and Construction Department. He was formerly assistant to the manager of engineering, Ebasco Services, Inc.

American Society of Heating and Air-Conditioning Engineers nominates **Peter B. Gordon** president. Gordon is vice president of Wolff and Munier, Inc.

Minneapolis-Honeywell Regulator Co. appoints **O. B. Wilson** vice president of its Brown Instruments Division. Wilson continues as general sales manager.

Illuminating Engineering Society confers honorary membership on **Dr. Irving Langmuir,** distinguished physicist-chemist. Dr. Langmuir until his retirement in 1950 was for 40 years with the General Electric Research Laboratory. His professional honors include the Nobel Prize, the Faraday Medal of the British Institute of Electrical Engineers, the Rumford Medal of the American Academy of Arts and Sciences, and the Franklin Medal of the Franklin Institute. He holds honorary degrees from 12 universities. ♦ ♦

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handy guide

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Clean up coal handling
Read page 38 and circle number 100
JOHNSON MARCH. An engineered liquid dust-control system will eliminate troublesome coal dust in all stages of your coal handling.

Full dust collecting capacity always
Read page 37 and circle number 101
THE NORTHERN BLOWER CO. Norblo automatic bag-type arresters maintain constant peak dust collecting efficiency.

AIR CONDITIONING, HEATING, VENTILATING

Don't be let down for fresh air
Read page 10 and circle number 102
COPPUS ENGINEERING CORP. Maintenance men work faster, do better work, and work longer without fatigue when they are fed better air.

BOILERS AND BOILER ACCESSORIES

Simplicity means safety
Read page 17 and circle number 103
MAGNETROL, INC. Almost unlimited operating life is offered by these boiler water level controls. Available for temperatures to 750 F.

Continuous blowdown without heat loss
Read page 40 and circle number 104
HENSZEY COMPANY. Write for more information on how you can insure automatic control of boiler water concentration.

Hot water fast
Read page 52 and circle number 105
PICK MANUFACTURING CO. Pick instantaneous water heaters are engineered for service.

Don't split responsibility
Read page 45 and circle number 106
PRAT-DANIEL CORP. Select all of your steam generating auxiliary equipment from the P-D line. Save time and trouble.

Heat water faster, cheaper
Read page 30 and circle number 107
THE JOHNSON CORPORATION. Write for literature giving further details on this heater that uses full pressure steam up to 250 psi. It gives faster, more efficient heat transfer.

COMING EVENTS

Look, see, compare
Read page 35 and circle number 108
NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING. See exhibits in every branch of the power field at the Power Show, New York Coliseum, November 26-30.

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For dependable renewable fuses
Read page 31 and circle number 109
MONARCH ELECTRIC CORP. From raw material to final inspection, every part is quality controlled.

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WESTERN INSULATED WIRE CO. Send for new catalog of Bronco wires and cables with Neoprene jackets.

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Read page 29 and circle number 117
CHESAPEAKE AND OHIO RAILWAY. Contact coal producers on the C & O for dependable deliveries of top-quality coal.

Cleans fuel bed, discharges ash
Read page 2 and circle number 118
DETROIT STOKER CO. Type C-C spreader stoker automatically cleans fuel bed and discharges ash continuously.

INSTRUMENTS AND CONTROLS

Red-reading mercury thermometers
Read page 38 and circle number 119
PALMER THERMOMETERS, INC. Thermometers in ranges from —40 to 950 F or equivalent in C. Write for Bulletin 35.

Water gages from stock
Read page 39 and circle number 120
ERNST WATER COLUMN & GAGE CO. Stainless steel or iron gages with ½-inch or ¾-inch connections are always available from stock.

Control oxygen accurately
Read page 34 and circle number 121
ARNOLD O. BECKMAN INC. Investigate complete oxygen analysis systems for higher combustion efficiencies at lower cost.

See them at the show
Read page 11 and circle number 122
PENBERTHY MANUFACTURING CO. See new Penberthy products, improvements and advances at Penberthy exhibit at the Power Show, Booth 445.

Double duty with single pilot
Read page 26 and circle number 123
LESLIE CO. Try Leslie Duo-Matic for accurate temperature regulation and control of steam flow. Single-unit internal pilot valve does both.

LIGHTING

Maintain pole lights economically
Read page 43 and circle number 124
THE THOMPSON ELECTRIC CO. Servisafe units eliminate climbing to relamp and clean, risk of electric shock. Write for Bulletin WPH-54.

LUBRICATION

Pressure system lubricant
Read page 49 and circle number 125
NEW YORK & NEW JERSEY LUBRICANT COMPANY. Prolong the life of your equipment with Non-Fluid Oil. Send for free sample.

Longer lasting gear lube
Read page 51 and circle number 126
ROTHLAN CORPORATION. Here is a gear lubricant for all gears not running in oil. Outlasts all others. Comes in handy spray cans.

How to save on penetrating oil
Read page 45 and circle number 127
ROTHLAN CORPORATION. There's absolutely no waste with this spray-can penetrating oil that is always ready to use, right on the job.

Stops thin-out!
Read page 7 and circle number 128
SINCLAIR REFINING CO. Rubilene holds its high film strength, reduces oil consumption. Write for free literature.

How to raise power output
Read page 56 and circle number 129
THE TEXAS CO. Change to Texaco Ursa oils to prevent harmful engine deposits, keep rings and valves free, raise power output.

MAINTENANCE ITEMS

Planned maintenance helper
Read page 45 and circle number 130
GRAPHIC SYSTEMS. Boardmaster Visual Control gives graphic picture of your operations.

Dustless commutator grinding
Read page 37 and circle number 131
IDEAL INDUSTRIES, INC. Vacuum attachment sucks up metal and stone dust, keeps dust out of machine, cuts commutator grinding time.

Tube cleaning equipment
Read page 41 and circle number 132
THOMAS C. WILSON, INC. New 112-page handbook gives data on cleaners for specific equipment in 14 major industries.

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Read page 34 and circle number 133
AIRETOOL MANUFACTURING CO. Airetool method of controlled expansion saves time, eliminates costly step rolling.

Stop oil leaks
Read page 41 and circle number 134
LAKE CHEMICAL CO. Seal your leaks with Oyltite-Stick. Not affected by heat and cold, withstands normal vibration.

Speed up rolling operation
Read page 49 and circle number 135
THE GUSTAV WIEDEKE CO. Series 1500 tube expanders can be used with drum or short header mandrels. Right-angle drive speeds up rolling operation. Send for bulletin.

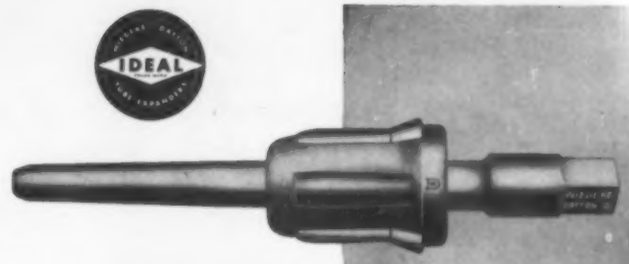
Gasket and packing always available
Read page 41 and circle number 136
RHOPAC, INC. Top quality gaskets and tapes, sheet gasket materials, packing hooks, and mechanical packings are always available quickly. Investigate this service now.

Lasting repairs for pennies
Read page 24 and circle number 137
SMOOTH-ON MANUFACTURING CO. Keep this wonder cement on hand for emergency repairs — it will not deteriorate.

Makes cutting fast and easy
Read page 36 and circle number 138
ZIMMERMAN PACKING. Spearhead extension gasket cutter has lightweight aluminum body. Inch and metric scales for cutting ease.

(more handy guide on page 50)

IDEAL



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Water Tube Boilers

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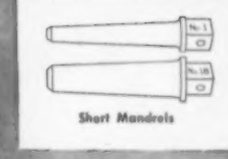
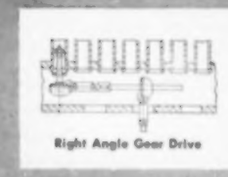
See your Dealer or write us for Bulletin.





THE GUSTAV **WIEDEKE** COMPANY
DAYTON 1, OHIO

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TRADE MARK REGISTERED

"STAYS ALIVE" LONGER IN ANTI-FRICTION BEARINGS

Over the years, many manufacturers have endeavored to develop lubricants to compete with NON-FLUID OIL, but none has succeeded in matching the desirable characteristics of this superior lubricant.

NON-FLUID OIL "stays alive" longer, lubricates dependably, until entirely consumed, protecting costly anti-friction bearings and prolonging their life. Dollar for dollar, pound for pound, day in and day out, NON-FLUID OIL gives more and better lubrication.

NON-FLUID OIL, the best buy in lubricants, is the only one that stands up. It stays in your bearings three times as long as ordinary greases. Write for free testing sample and descriptive bulletin . . . no obligation, of course.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
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NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

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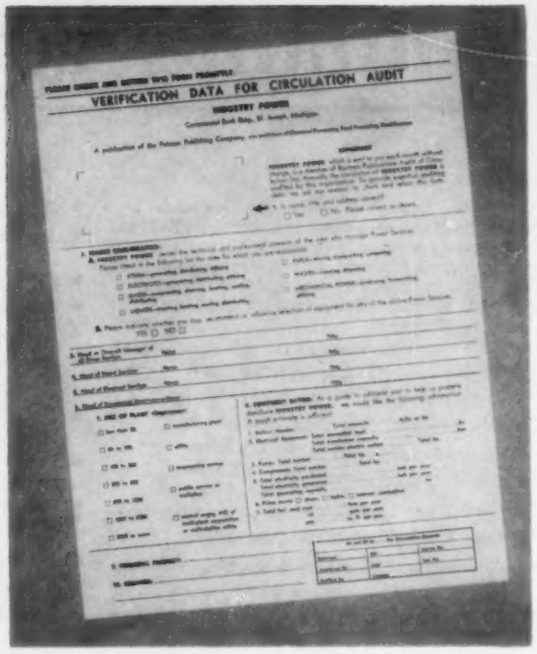
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ST. LOUIS 3, MO.: 1221 Locust St.

ENGINEER CO. .....Page 42

CHICAGO 4, ILL.: George J. Zanke, 53 W. Jackson Blvd., HArrison 7-5848.
CINCINNATI, OHIO: Fred Ellman, 1013 Fed. Reserve Bank Bldg.
CLEVELAND, OHIO: Ashmead-Danks Co., 316 Marion Bldg. MAin 1-6192.
DETROIT 2, MICH.: Agren Ascher Co., 5-121 Gen. Motors Bldg.
KANSAS CITY 11, MO.: Hughes Machinery Co., 4212 Main St., VAlentine 1-7021.
MEMPHIS, TENN.: Power Equipment Co., 1258 Madison Ave.
ST. LOUIS 8, MO.: Rhodes Equip. Co., 4485 Olive St.
ST. PAUL 1, MINN.: Commonwealth Electric Co., 417 Broadway, CApitol 4-1526.

ERNST WATER COLUMN & GAGE CO. .....Page 39

LIVINGSTON, N. J.: 252 S. Livingston Ave.

GRAPHIC SYSTEMS, INC. .....Page 45

NEW YORK, N. Y.: 55 W. 42nd St.

HENSZEY CO. .....Page 40

WATERTOWN, WIS.: 204 Water St.

HUNGERFORD & TERRY, INC. .....Page 33

CHICAGO 4, ILL.: Ross Engineering, 224 S. Michigan Ave., WEbster 9-4721.
CLEVELAND 3, OHIO: R. D. Murphy, 6801 Euclid Ave., HEnderson 2-1900.
DETROIT 27, MICH.: Clifford B. Armstrong, Jr., 16817 Grand River Ave., VErmont 8-4248.
INDIANAPOLIS 20, IND.: H. C. Ohge, 5324 Primrose Ave., BRoadway 7316.
KANSAS CITY 9, MO.: Parker & Foster, 3519 Troost Ave., JEfferson 4490.
LOUISVILLE 2, KY.: Allan K. Cook Co., 604 W. Main St., WAbash 1269.
MEMPHIS 5, TENN.: C. J. Gaskell Co., 216 N. Lauderdale Ave., MEmphis 8-2241.
ST. LOUIS 10, MO.: Hudson Chem. Co., 4010 Chouteau Ave., JEfferson 1-7843

IDEAL INDUSTRIES, INC. .....Page 37

SYCAMORE, ILL.: 1006 Park Ave.

JOHNSON CORP. .....Page 30

THREE RIVERS, MICH.: 807 Wood St.

JOHNSON-MARCH CORP. .....Page 38

BIRMINGHAM, MICH.: J. H. Fortune & Son, 646 N. Woodward Ave.
CHICAGO, ILL.: Victor H. Jones Co., 100 W. Monroe St.
CLEVELAND 14, OHIO: McLean Company, 3525 Lakeside Ave.
CLEVELAND 15, OHIO: Hallman Company, 1900 Euclid Ave.
CHICAGO 4, ILL.: B. E. Schonthal & Co. Inc., 28 E. Jackson Blvd.
CINCINNATI 30, OHIO: J. H. Ballenger, 2067 Beechmont.
COLUMBUS 15, OHIO: United Equipment Co., 538 E. Town St.
CROSBY, MINN.: Stanley B. Troyer Co., Theatre Bldg.
DAVENPORT, IOWA: Ralph E. Little, 3315 Davenport Ave.
DAYTON 9, OHIO: Wm. J. Meyers, 3700 Hertland Drive.
DES MOINES, IOWA: Carl Grimes & Company, 1000 9th St.
DETROIT 7, MICH.: Wolverine Foundry & Supply Co., 3211 Bellevue Ave.
HERRIN, ILL.: J. W. Norton, 209 S. 18th St.
INDIANAPOLIS, IND.: Acme Engineering Agency, 2051 E. 46th St.
INDIANAPOLIS 20, IND.: R. B. Epperson, 5915 Indianola Ave.
KANSAS CITY, MO.: Hughes Machinery Co., 4214 Main St.
KANSAS CITY 6, MO.: Western Fuel & Supply Co., 12th & Walnut St. Bldg.
MILWAUKEE, WIS.: Dorner Company, Box 1000, 5341 N. Hollywood Ave.
MEMPHIS, 17, TENN.: Walter H. Gay, 1024 S. Perkins Road.
SESSER, ILL.: Farrell Page, Box 504.
ST. LOUIS 8, MO.: Rhodes Equipment Co., 4485 Olive St.
TOLEDO 10, OHIO: Western Ohio Ventilating Co., 2909 Detroit Ave.

LAKE CHEMICAL CO. .....Page 41

CHICAGO 12, ILL.: 3070 W. Carroll Ave.

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LESLIE CO. .....Page 26
APPLETON, MILWAUKEE, WIS.: Donald E. Riley & Co., Inc.
BIRMINGHAM, MICH.: George W. Murphy Co.
CHICAGO, ILL.: Instrument Associates.
CINCINNATI, OHIO: The A. A. Betts Co.
CLEVELAND, OHIO: W. M. Wilson Co.
DAVENPORT, IOWA: Saycon Inc.
DES MOINES, IOWA: W. W. Stuart.
FERN CREEK (LOUISVILLE), KY. J. Zimmermann.
GRAND RAPIDS, MICH.: Robert W. Shedd.
INDIANAPOLIS, IND.: Young-Streeter Co.
KANSAS CITY, MO.: Mooney Engrg. Co., Inc.
KINGSPORT, CHATTANOOGA, TENN.: Abernathy-Thomas Engineering Co.
MEMPHIS, TENN.: Power Equipment Co.
MINNEAPOLIS, MINN.: Plant Equipment Inc.
MINNEAPOLIS, MINN.: Plant Equipment, Inc.
MINNEAPOLIS, MINN.: Plant Equipment, Inc.
ST. LOUIS, MO.: Roger P. Kipp Co., Inc.
YOUNGSTOWN, OHIO: Brenner Industrial Sales & Supply Co.

MAGNETROL, INC. .....Page 17
CHICAGO 10, ILL.: Meters and Controls, 444 North LaSalle St., WHitehall 4-1440.
CLEVELAND 23, OHIO: Illes Power Control Co., 22700 Shore Center Dr., REdwood 2-9300.
CLINTON, IOWA: Meters and Controls, Room 208, Johannes Bldg., CHapel 2-2033.
DAVENPORT, IOWA: Deco Engineering Products, 330 Western Ave., 7-6123.
DES MOINES 9, IOWA: Deco Engineering Products, 1112 Locust St., 8-5721.
DETROIT 7, MICH.: Smith Instrument & Equipment Co., 1900 East Jefferson Ave., LOrain 7-3550.
GRAND RAPIDS 7, MICH.: Kress Engineering & Sales Co., 1342 Burton Ave., S. E., GLendale 2-9176.
INDIANAPOLIS 5, IND.: C. M. Buck, 2927 Central Ave., WAlnut 5-1832.
KANSAS CITY, MO.: Economy Equipment Co., 7341 Broadway, JAckson 3-1010.
MEMPHIS 5, TENN.: C. J. Gaskell Co., Inc., 216 North Lauderdale Ave., 8-2241.
MINNEAPOLIS 9, MINN.: Engineered Sales, 314 West 38th St., LOcust 0696.
MUSKEGON, MICH.: Smith Instrument & Equipment Co., 1466 Bearsley.
RIPON, WIS.: Yates Equipment & Supply Co., P. O. Box 331, BLack 600.
ST. LOUIS, MO.: Economy Equipment Co., 4526 Olive St., FOrest 5328.
TOLEDO 9, OHIO: Mason Equipment Co., 1601 Broadway, FUlton 4269.

MANHATTAN RUBBER DIV. RAYBESTOS-MANHATTAN, INC. ..Page 6
CHICAGO, ILL. CLEVELAND, OHIO
DETROIT, MICH. ST. LOUIS, MO.
MINNEAPOLIS, MINN.

MICHIGAN OVEN CO. .....Page 28
ANDERSON, IND.: Mr. H. O. Bennett, P. O. Box 131.
CHICAGO 30, ILL.: Louis H. Asman, 6274 N. Leona Ave.
CLEVELAND 15, OHIO: J. R. Engle Co., 1900 Euclid Ave.
DETROIT 1, MICH.: R. W. Proctor, 415 Brainard Ave.
DETROIT 1, MICH.: B. P. Shiller, 415 Brainard.
WEBSTER GROVES 19, MO.: J. C. Rosborough, 103 Jefferson Rd.

MONARCH ELECTRIC CORP. .....Page 31
JAMESTOWN, N. Y.: 118 E. First St.

JAS. A. MURPHY & CO., INC. .....Page 30
HAMILTON, OHIO: Box 614

NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING ..Page 35
NEW YORK, N. Y.: 480 Lexington Ave.

NEW YORK & NEW JERSEY LUBRICANT CO. .....Page 49
CHICAGO, ILL.: N. Y. & N. J. Lubricant Co., 846 West Harrison Street.
CHICAGO 26, ILL.: J. N. Seng, 6151 S. Honore St.
CLEVELAND HEIGHTS 18, OHIO: G. W. Brenholts, 2228 Lamberton Road.
DALLAS 1, TEX.: Textile Supply Co., 1002 Cedar Springs.
DETROIT, MICH.: A. A. Vogler, 4150 Haverhill Ave.
FORISTELL, MO.: A. H. Harlan, RFD 1, Box 191.
GREENSBURG, PA.: R. A. Henkel, 303 Center Ave.
LANETT, ALA.: A. M. Cowan, Box 563.
SOUTH HILLS, COVINGTON, KY.: S. F. Britton, 1503 Henry Clay Ave.

NORTH AMERICAN MOGUL PRODUCTS CO. .....Page 46
CLEVELAND 13, OHIO: Standard Bldg.

NORTHERN BLOWER CO. .....Page 37
CLEVELAND 2, OHIO: 6300 Barberton Ave.

PALMER THERMOMETERS, INC. ....Page 38
CHICAGO 30, ILL.: Becker Engineering & Supply Co., 6539 N. Minnehaha Ave., ROdney 3-3187.
CINCINNATI 2, OHIO: Price Y Cia, Inc., 824 Dixie Terminal Bldg., MAin 1-3038.
CINCINNATI 3, OHIO: Plant Equipment Co., Union Terminal Bldg., PA 1-6183 or GR 1-1552.
CINCINNATI 12, OHIO: Frank W. Probst, 2301 Norwood Ave., MElrose 1-1500.
CLEVELAND, OHIO: H. R. Bowers, 1039 Leader Bldg., MAin 1-2960.
DETROIT 27, MICH.: Industrial Instrument Supply & Mfg. Co., 14223 Robson Ave., VErmont 8-5940.
INDIANAPOLIS 8, IND.: Paller Engineering Co., 3025 N. Illinois St., TAlbot 5444.
MEMPHIS 12, TENN.: Engineered Instrument Sales Co., 2717 Union Ave., 33-1275.
MILWAUKEE 17, WIS.: Charles D. Haven, Jr., 8477 North Lake Drive, WOodruff 2-5139.
ST. LOUIS 20, MO.: Carl F. Gast Co., 6110 Gareche Ave., EVergreen 3-0750.
ST. PAUL 4, MINN.: John L. Schmidt, 1879 University Ave., NEstor 6363.

PENBERTHY INJECTOR CO. .....Page 11
CHICAO, ILL.: Ray Williams, 333 No. Michigan Ave., DEarborn 2-7675.
CLEVELAND 3, OHIO: Mussun Equipment Co., 2012 E. 46th St., Utah 18244.
DETROIT 19, MICH.: Jeu-de-Vine & Woodcox, 19334 W. 7 Mile Rd., KEnwood 36400.
LOUISVILLE, KY.: Leo F. Brown, 1534 Bardstown Rd., HIghland 6010.
MEMPHIS, TENN.: T. M. Cox, P. O. Box 2115, EXpress 7-2103.
MINNEAPOLIS 8, MINN.: Dale Rennebohm, 2300 Oliver Street S., LEnwood 6740.
ST. LOUIS 22, MO.: T. Rankin, 533 E. Argonne Dr., YOrktown 8-8454.

PICK MFG. CO. .....Page 52
WEST BEND, WIS.: 49 Alan Ave.

PRAT-DANIEL CORP. .....Page 45
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RAYBESTOS-MANHATTAN, INC. ....Page 6
See Manhattan Rubber Div.

REPUBLIC MFG. CO. .....Page 43
CANTON, OHIO: Cliff Ostle, E. W. Bliss.
CHICAGO, ILL.: George H. Goecke, Windsor Wilson Apt. Hotel, 915 Wilson Ave.
KIRKWOOD 22, MO.: Tom G. Rankin, 533 E. Argonne Dr.

RHOPAC, INC. .....Page 41
SKOKIE, ILL.: 3424 Cleveland.

RONNINGEN-PETTER MFG. CO. ....Page 44
VICKSBURG, MICH.

ROTHLAN CORP. .....Page 45 & 51
ST. LOUIS 8, MO.: 3618 Laclede Ave.

SALEM-BROSIUS, INC. .....Page 32
CARNEGIE, PA.: Arch St.

SINCLAIR REFINING CO. .....Page 7
NEW YORK 20, N. Y.: 630 5th Ave.

SMOOTH-ON MFG. CO. .....Page 24
JERSEY CITY 4, N. J.: 470 Communipaw Ave.

SORGEL ELECTRIC CO. .....Page 22
CHICAGO 41, ILL.: L. L. Weldy & Associates, 4201 W. Irving Park Rd., Spring 7-8575 and 7-8576.
CLEVELAND 15, OHIO: Harvey E. Lakin, 3521 Euclid Ave., Endicott 1-6748.
COVINGTON, KY.: H. E. Bracke, 1053 Madison Ave., Hemlock 1-2299.
DAVENPORT, IOWA: Midwest Equipment Co. of Iowa, P. O. Box 532, 7-7074.
DES MOINES 14, IOWA: Midwest Equipment Co. of Iowa, 842 Fifth Ave., Cherry 3-1203.
DETROIT 35, MICH.: Wm. H. Yeomans, 19036 West McNichols Rd., Vermont 8-1808.
INDIANAPOLIS 20, IND.: Kyle G. Herder, P. O. Box 5952, Clifford 5-1361.
KANSAS CITY 3, MO.: Fleming & Co., 3021 Main St., Plaza 3-0111 and 3-0112.
MILWAUKEE 2, WIS.: L. L. Weldy & Associates, 833 E. Kilbourn Ave., Broadway 3-6761.
MINNEAPOLIS 15, MINN.: Electrical Jobbers Equipment Co., 619 Fourth Ave., South, Federal 6-6321.
ST. LOUIS 16, MO.: Charles H. Douglas, 4445 Gustine Ave., Flanders 1-1100.

TEXAS CO. .....Page 56
NEW YORK, N. Y.: 135 E. 42nd St.

THERMIX CORP. .....Page 45
CHATTANOOGA 2, TENN.: Edgar A. Rogers, Chattanooga Bank Bldg.
CHICAGO 6, ILL.: Cochrane Engineering Corp., 309 West Jackson Blvd.
CINCINNATI 2, OHIO: Ellman Equipment Co., 1029 Federal Reserve Bank Bldg.
CLEVELAND 15, OHIO: The H. W. Kainer Co., 1836 Euclid Ave.
DETROIT 12, MICH.: Metrol Co., 7145 E. Davison.
KALAMAZOO, MICH.: Metrol Co., 420 West South St.
KANSAS CITY 6, MO.: The Hesler Co., 1233 Dierks Bldg.
MILWAUKEE 3, WIS.: Cochrane Engineering Corp., 1753 West Wisconsin Ave.
MINNNEAPOLIS 4, MINN.: Hoyt A. Sevey, 1525 South 5th St.
ST. LOUIS 8, MO.: Power Economy, Inc., 4526 Olive St.
TOLEDO 2, OHIO: Metrol Co., 2144 Madison Ave.

THOMPSON ELECTRIC CO. .....Page 43
CLEVELAND 14, OHIO: 1111 Power Ave.

TOLEDO PIPE THREADING MACHINE CO. .....Page 5
TOLEDO, OHIO: 1431 Summit St.

UNIBLOW VALVE CO. .....Page 51
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WESTERN INSULATED WIRE CO. ...Page 50
LOS ANGELES, CALIF.: 3425 E. 30th St.

GUSTAV WIEDEKE CO. .....Page 47
CHICAGO 32, ILL.: Chicago Tube & Iron Company.
CHICAGO 7, ILL.: Crerar, Adams & Company.
CLEVELAND 1, OHIO: The W. M. Pattison Supply Co.
DETROIT 17, MICH.: A. J. Baxter & Company.
INDIANAPOLIS, IND.: W. J. Holliday & Co.
KANSAS CITY, MO.: Langdon Supply Company.
LOUISVILLE 8, KY.: Neill-LaVielle Supply Co., Inc.
MINNEAPOLIS, MINN.: Chas. W. Stone Co.
ST. LOUIS 8, MO.: Corby Supply Company.

EDWIN L. WIEGAND CO. .....Page 35
CHICAGO 5, ILL.: Fred I. Tourtelot Co., 407 S. Dearborn St., HArrison 7-5507, 7-5508, 7-5509.
CINCINNATI 8, OHIO: The Smyser Company, 1046 Delta Ave., TRinity 1-0605, 1-0606.
CLEVELAND 13, OHIO: Anderson-Bolds, Inc., 2012 W. 25th St., PRospect 1-7112.
DAVENPORT, IOWA: Volco Company, 215 Kahl Bldg., 3-2144.
DES MOINES 14, IOWA: Midwest Equipment Co. of Iowa, 842 Fifth Ave., DEs Moines 3-1203.
DETROIT 38, MICH.: Carman Adams, Inc., 15760 James Couzens Highway, UNiversity 3-9100.
INDIANAPOLIS 4, IND.: Couchman-Conant, Inc., Architects & Builders Bldg., MElrose 5-5313.
KANSAS CITY 6, MO.: Fraser D. Moore Co., 106 E. 14th St., Victor 3-3306.
MILWAUKEE 3, WIS.: Gordon Hatch Co., 531 W. Wisconsin Ave., BRoadway 1-3021.
MINNEAPOLIS 4, MINN.: Volco Company, 831 South Sixth St., FEderal 6-3373.
NASHVILLE 4, TENN.: H. R. Miles and Associates, 2508 Franklin Road, CYpress 2-7016.
ST. LOUIS 1, MO.: C. B. Fall Company, 317 North 11th St., CHestnut 1-2433.

THOMAS C. WILSON, INC. .....Page 41
LONG ISLAND CITY 1, N. Y.: 21-11 44th Ave.

ZIMMERMAN PACKING CO. .....Page 36
CHICAGO 30, ILL.: Andrews Asbestos & Rubber Co., 6201 N. Crawford Ave.
CINCINNATI 12, OHIO: 2768 Highland Ave.
CINCINNATI 38, OHIO: The Louder Co., 3833 Thornton Drive.
DULUTH 2, MINN.: 224 YMCA Bldg.
LIMA, OHIO: 1000 West Wayne St.

coming events

. . . for industry power

Nov. 25-30	ASME Annual Meeting	Hotel Statler, New York City
Nov. 25-30	ASME Power Show	Coliseum, New York City
Nov. 26-30	Third International Automation Exposition	Trade Show Building, New York City
Dec. 3-5	Air Pollution Control Association Semiannual Meeting	Rice Hotel, Houston, Texas
Dec. 5-7	IRE Instrumentation Conference and Exhibit	Biltmore Hotel Atlanta
	1957	
Jan. 21-22	Association for Applied Solar Energy Symposium	Hotel Westward Ho, Phoenix
Jan. 21-25	AIEE Winter General Meeting	Hotel Statler, New York City
Jan. 28-31	Plant Maintenance & Engineering Show	Cleveland
Feb. 18-21	Industrial Ventilation Conference	Kellogg Center, Michigan State University, East Lansing

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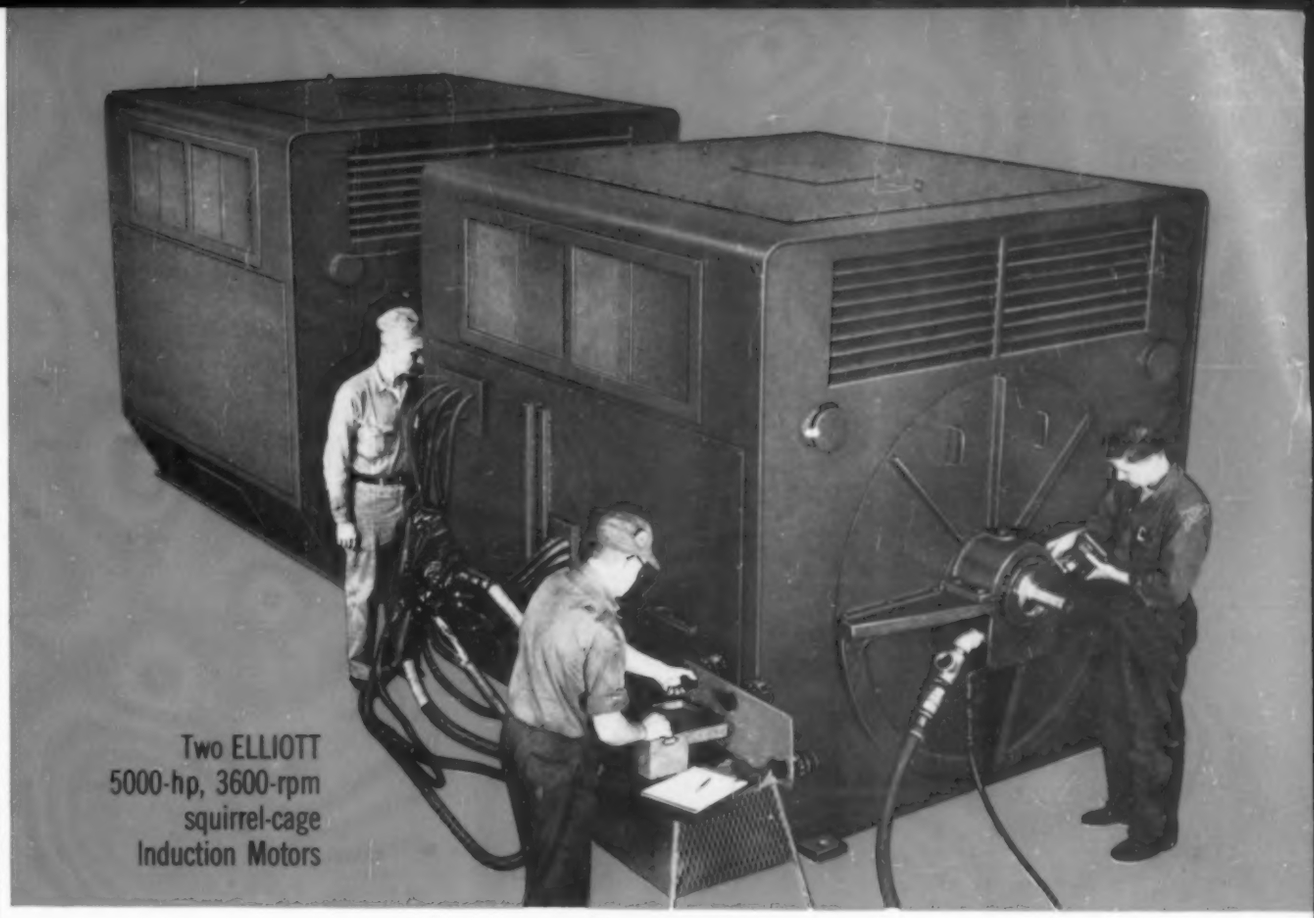

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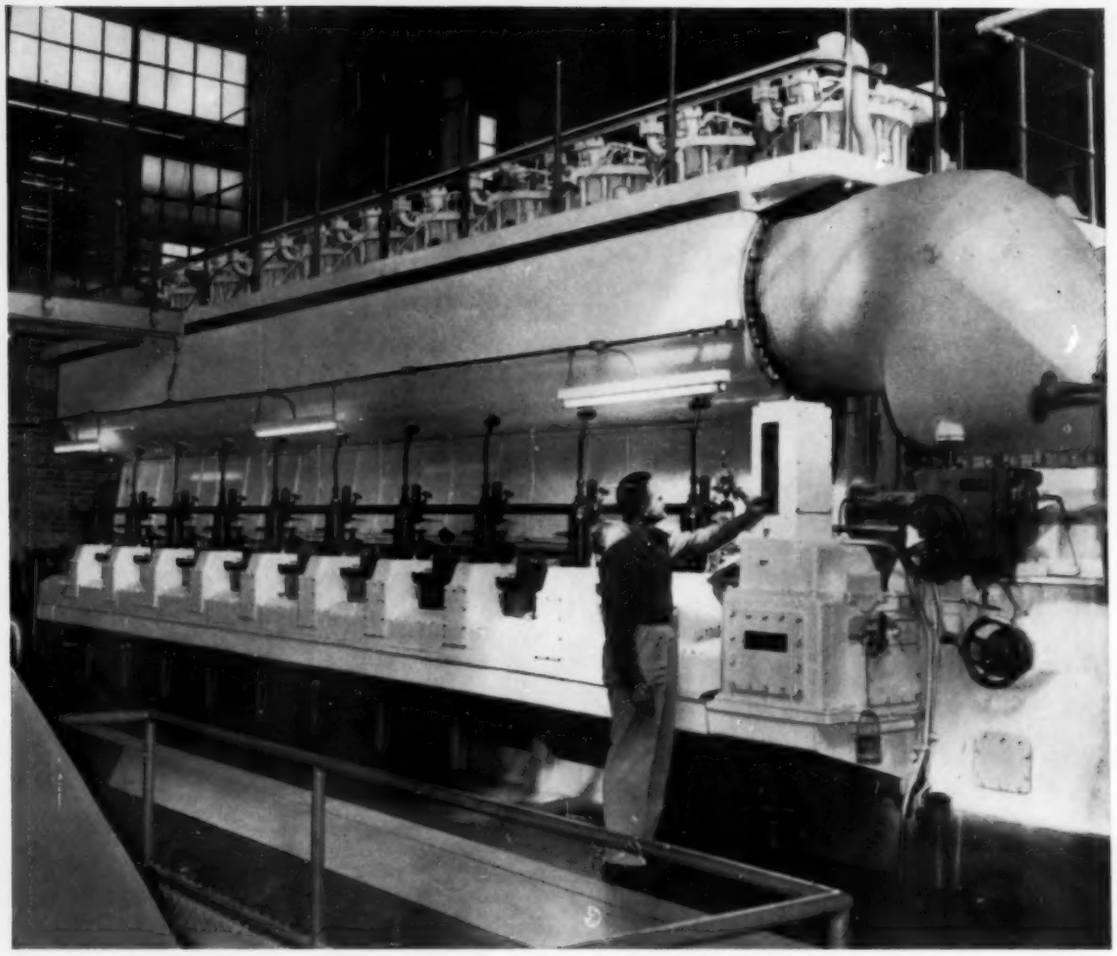

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